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11.1 SOURCE TERMS

Radioactive material from the operation of the plant arose from two sources. First, the products of nuclear fission are generally radioactive. Some may escape from the fuel from time to time. A small number of fission reactions also occur outside of the fuel from uranium as an impurity existing on or in the components near the reactor core and the cooling water flowing through the core. Second, a small fraction of the neutrons available from the fissioning process were captured by various materials near the reactor core including impurities in the circulating primary coolant. Many of these products of neutron capture become radioactive.

The License (Technical Specifications) for the plant includes requirements that gaseous radioactive dose rates be limited to no more than 500 mrem per year to be delivered at any point in the off-site environment. Liquid releases are to be limited so that it was unlikely that any individual would be exposed to radiation in excess of that permitted by regulations (exposure greater than permissible concentrations of 10 CFR 20).

The liquid and gaseous waste systems installed at the plant provide flexibility and processing capability to meet this criterion. The operational history of the plant, particularly during the period of significant fuel failures, has validated the design, in that effluent limitations based upon the limiting dose criterion were never approached.

On June 4, 1976 Consumers Power Company submitted the necessary information to permit the USNRC to evaluate the effectiveness of the radioactive waste treatment systems at the plant in accordance with the then, newly established Appendix I to 10 CFR 50. This submittal was supplemented by submittals of December 3, 1979, August 28, 1980, June 7, 1982 and September 29, 1982. On May 15, 1981 the NRC published their evaluation and concluded that the installed systems are capable of maintaining releases within the design objectives of Appendix I. The requirements of Appendix I much more severely limit radioactive effluents than the original limits imposed on the plant. These limits, called Design Objective Annual Quantities, are defined in the Off-Site Dose Calculation Manual and establish the long term upper limit for radioactive materials concentrations in effluent streams.

11.1.1 ACTIVATION PRODUCTS

The discussion of activation products in the primary coolant system was deleted for decommissioning. In late 1997 and early 1998 the primary coolant system was chemically decontaminated to lower general dose rate for dismantlement.

11.1.2 FISSION PRODUCTS

The discussion of fission products in the primary coolant system was deleted for decommissioning. In late 1997 and early 1998 the primary coolant system was chemically decontaminated to lower general dose rate for dismantlement.

11.1.3 HIGH INTEGRITY CONTAINER (HIC) RESIN FIRE

An analysis was performed to estimate the potential radioactive material release from a fire postulated to occur during the dewatering process of spent resins prior to shipment (Reference engineering analysis EA-BRP-RG-9702, dated November 19, 1997). Spent resins are transferred and stored in tanks with water. The drying process of resins transferred to a high integrity container involves pumping out the excess water followed by circulating warm air through the resins until the air indicates that the resin beads are dry. A resin fire is therefore only possible after drying.

The analysis determined an estimated HIC activity of 147 Ci. Release fractions into the air were determined in accordance with 10CFR30.72 for the individual radionuclides assumed present. Atmospheric dispersion to the site boundary was in accordance with the short term ground level dispersion recommendations of Regulatory Guide 1.25, Figure 1. Dose conversion factors for dose to the public at the site boundary were taken from Table 5-1 of EPA 400-R-92-001. These dose conversion factors provide Total Effective Dose Equivalent (TEDE) from combined external, internal and deposition sources. Conversion factors from Table 5-2 of EPA 400-R-92-001 were used for the Committed Dose Equivalent (CDE) to the thyroid.

The results showed that dose at the closest site boundary for the postulated fire is 95.5 mrem TEDE and 175 mrem thyroid CEDE for the duration of the event.

The primary system radioactivity had been estimated to be approximately 300 Ci. Assuming that all this activity, released during a chemical decontamination of the system, is contained in a single HIC (three or more are expected to be used) the site boundary dose following the postulated resin fire would be 195 mrem TEDE and 357 mrem thyroid CDE.

All calculated doses are well within the PAGs of 1.0 rem TEDE and 5.0 rem CDE.

Chemical decontamination of the primary system and the primary coolant side of the shutdown and reactor cleanup systems resulted in the removal of approximately 400 Ci of activity. While this total is greater than that estimated for the resin fire, the calculated doses would still remain well below the PAGs.

11.2 LIQUID WASTE MANAGEMENT SYSTEM

Radioactive materials in liquid waste arise from the activation of corrosion products formed in the nuclear steam supply system and the possible escape of fission products from fuel element cladding defects.

11.2.1 DESIGN BASES

The liquid waste system is of sufficient design such that expected source terms during power operation could be processed so that release of effluents was kept within the numerical guidance of Appendix I to 10 CFR 50. System design capacity allows for temporary short term waste volume increases and the ability to store some liquids for reasonable periods of time to permit decay of short lived radioactive material. The use of both filtration and demineralization prior to release, when necessary, will be retained during decommissioning. The system is also designed with the waste tanks behind a shield wall which separates the bulk of the waste from the valves and other controls normally manipulated to process the liquid. The capability to recycle collected liquids to obtain a representative sample is provided. The system is designed to operate in a batch discharge mode to insure careful control of all liquids released. When a predetermined concentration is exceeded, alarms are automatically received allowing for the manual termination of the release.

11.2.2 SYSTEM DESCRIPTION

The liquid waste management system consists of collection sumps, receiver tanks, hold-up tanks, tank mixing eductors, strainers, filters, a demineralizer, pumps, interconnecting piping and instrumentation. The system is designed to be capable (all pumps operating continuously), to process approximately 70,000 gallons per day.

Drawing 0740G40132 presents a block collection diagram for the liquid waste management system. Liquids to be processed are segregated based upon total solids content. Waste water which normally has a low solids content is collected in a "clean" sump in the containment building and routed to one or both of the 5000 gallon clean waste receiver tanks. Clean waste is almost always processed for reuse in the plant though provisions exist to mix, sample, analyze and discharge the collected liquids.

Waste water, arising from sources within the containment building, with potentially high solids content is collected in a "dirty" sump (a sump also exists in the turbine building). Provision exists to route water collected by these two sumps to either the "dirty" or "clean" waste receiver tanks. Normally, the liquids are of sufficiently high purity so that they can be routed to the clean waste tanks.

A fourth sump, the "radwaste" sump, exists in the liquid radioactive waste area which collects water overflow from the spent resin or other liquid waste tanks as well as liquids from various floor and equipment drains. The collected liquids are routed to the dirty waste receiver tanks. Two 5000 gallon tanks exist with one tank undergoing processing while the second is filling.

The liquids to be discharged are mixed to obtain a representative sample, then sampled, analyzed and normally filtered prior to being released at controlled rates to assure effluent limits are not being exceeded.

A single 5000 gallon Chemical Waste Receiver tank is also provided which collects liquids from radioactive sinks, emergency showers, the plant laundry and equipment decontamination area drains, including the decontamination sink and shower, located in the modular Access Control Building. Though provision exists to recycle these liquids, they contain a high solids and organic content, much of which may be in colloidal suspension and cannot be processed for reuse, hence these liquids are normally all discharged after mixing, sampling, analyses and filtration similar to that conducted on all "dirty" waste releases. Drawing 0740G40108 shows a schematic diagram of the liquid waste management system including all tanks, pumps, valves, instruments and interconnecting piping. Clean waste, after collection in a clean waste receiver tank, is typically routed through a strainer/filter, a cartridge filter, the radwaste demineralizer to one of two waste hold tanks. Water can then be pumped to the condensate storage tank. Dirty waste, after collection in a dirty waste receiver tank, is either processed to a clean waste receiver tank and further processed as clean waste if its solids content is sufficiently low or after the strainer/filter it is normally further cleaned by a second filter prior to discharge. Chemical waste after collection is normally filtered prior to discharge.

The construction of the liquid waste management system is consistent with conventional construction practice. No seismic design specifications or criteria were applied to equipment and components within the system. The construction of the structure, an underground concrete vault housing the system, was designed consistent with the Uniform Building Code which includes a specification for a 0.025g static horizontal load. A 1981 analysis of the structure by D'appolonia Associates concluded, however, that the structure has an adequate safety margin at USNRC Regulatory Guide 1.60 spectra anchored at 0.12g zero-period acceleration. Any overflows, leaks, spills or component breakage is thus expected to be retained by the structure under credible seismic events. Even so, should radioactive liquids be released to the underground strata their travel is limited by the low horizontal velocity (0.05 feet/day) toward Lake Michigan.

11.2.3 RADIOACTIVE RELEASES

Releases of radioactive liquids to the environment have remained consistent over the past several years. Table 11-1 presents an annual average summary of discharged liquids. Levels of radioactivity are expected to decrease with time as dismantlement proceeds. Releases will be kept as low as reasonably achievable.

TABLE 11-1 TYPICAL ANNUAL LIQUIDS RADIOACTIVE EFFLUENT DATA (No Significant Fuel Defects)	
Variable	Annual Quantity (gallons for volume and curies for radioactive material)
Volume Released	1.2E5
"clean" waste	2.4E3
"dirty" waste	2.0E4
"chem." Waste	9.8E4
Radioactivity	
Total alpha	7.2E-6
Tritium	4.2E-1
Fission and activation products	1.8E-1
Radionuclides in Fission and Activation Products	
Cr-51	7.4E-3
Mn-54	3.8E-2
Co-58	7.9E-5
Fe-59	4.6E-3
Co-60	4.0E-2
Zn-65	2.2E-3
Sr-89	5.0E-4
Sr-90	1.5E-4
Nb-95	4.6E-5
Mo-99	9.7E-5
Ag-110M	4.2E-4
Sb-124	1.8E-4
Cs-134	5.0E-3
Cs-137	2.6E-2
Unidentified Beta	5.0E-2

11.3 GASEOUS WASTE MANAGEMENT SYSTEM

Some radioactive materials in gaseous discharges are expected as a result of the decontamination and dismantling operations.

11.3.1 DESIGN BASES

The gaseous waste system is of sufficient design such that the expected source term inputs can be processed maintaining the release of effluents within the numerical guidance of Appendix I to 10 CFR 50.

Typically the plant ventilation system is not filtered or processed prior to discharge. However, a high efficiency particulate air (HEPA) filtration system has been provided in the exhaust path from containment for use during decommissioning activities that potentially could significantly increase radioactive particulate production (e.g. primary system chemical decontamination or reactor cavity concrete demolition). This HEPA was installed to provide consistency with assumptions made in the Generic Environmental Impact Statement (GEIS). Ventilation flow rate controls are provided to permit appropriate flow distribution to minimize the spread of airborne radioactive contamination within the plant, Drawing 0740G40119 shows the ventilation arrangement for the plant. All ventilation is directed to the stack where continuous sampling, monitoring and an alarm feature exists if releases exceed a predetermined setpoint. Refer to Chapter 9, Subsection 9.4 of this Updated FHSR for a description of the Ventilation System.

11.3.2 SYSTEM DESCRIPTION

The gaseous waste system consists of ventilation fans, ducting dampers, louvers, filters, a 240 foot high stack, controls and instrumentation to: 1) provide for the controlled release (below regulatory limits) and dispersion of the noble fission gases which can be released in significant quantities during times of fuel element failure, 2) provide sufficient ventilation to minimize airborne contamination within the plant; and 3) keep radioactive particulate releases to the environment below regulatory limits.

Drawing D740G40124 and D740G40125 show the plant ventilation scheme. With the exception of the containment building ventilation all are induced draft flows with the stack fans providing the energy source. The containment building system also contains inlet supply fans which provide a forced draft contribution to ventilation. Flow rates are varied consistent with area heating and dismantlement activity requirements but remain sufficient to minimize build-up of airborne contamination. Stack flow is kept constant at about 30,000 cfm by the use of louvers in the stack base. Two full capacity fans are provided. The ventilation flow is continuously sampled by an isokinetic sampler within the stack which allows particulate and noble gas monitoring of stack effluents. Should this system become inoperable, particulate activity monitoring may be accomplished via mobile continuous air monitors, or grab samples can be taken and analyzed for particulate activity at least once per 24 hours for calculation of release quantities.

The construction of the gaseous waste system is consistent with conventional construction practice. No seismic design specifications or criteria were applied to equipment and components within the system. The construction of the stack, however, was designed consistent with the Uniform Building Code which includes a specification for a 0.025g static horizontal load. A 1981 analysis of the stack by D'appalonia Associates concluded however that it has an adequate safety margin using USNRC Regulatory Guide 1.60 spectra anchored at 0.12g zero-period acceleration.

11.3.3 RADIOACTIVE RELEASES

Releases of radioactive materials from the gaseous waste system including plant ventilation are not expected to exceed the values listed in Table 11-2.

11.4 SOLID WASTE MANAGEMENT SYSTEM

Solid radioactive wastes (other than spent nuclear fuel) are composed of ion exchange resins, equipment that is in contact with the primary coolant, radioactive waste systems or neutron field from the reactor core, filters that filter radioactive gaseous or liquid streams and worn out protective clothing, plastic sheeting, tape, absorbent paper and the like which are used in working on, storing or isolating radioactive equipment. All site material is considered potentially radioactive waste until cleared by Health Physics. Storage of these solids is accomplished in locations approved by Health Physics.

11.4.1 DESIGN BASES

The solid waste management system is designed to accept radioactive solids and store them safely in sufficient volume to accommodate several shipments. Shielding is provided to minimize radiation exposure to workers while handling and shipping the wastes. System design capacity allows the accumulation of several years of wastes so that decay of the shorter lived material can occur prior to shipments, and to permit continued plant decommissioning activities in the event shipment and disposal is temporarily unavailable.

Currently Michigan has access to several radioactive waste disposal sites. It is possible that access rights will change and that Big Rock Point will have to store solid radioactive waste until a disposal site becomes available. If access is denied the philosophy will be to stabilize the waste as much as possible and package in accordance with current requirements to allow shipment to a burial site when available.

11.4.2 SYSTEM DESCRIPTION

The solid waste management system consists of a water filled Spent Fuel Pool that accepts radioactive items including Greater Than Class C (GTCC) components removed from the reactor vessel, and a separate Radioactive Waste Building that is used for storing other solid radioactive wastes. Temporary storage of radioactive resins discharged from liquid radioactive waste system and the Spent Fuel Pool demineralizers is accomplished by the use of High Integrity Containers (HICs) located in the former condenser area or the containment building.

High Integrity Containers (HICs) containing resins or filter media can be placed in concrete storage modules until they can be shipped.

The Radwaste Building, which is located within a security fenced area of the plant (reference Chapter 2, Figure 2.3), has a shipping bay, crane, shielded areas for higher level wastes and sufficient storage capacity for several years accumulation of plant produced radioactive wastes. Compactible and incinerable wastes are normally accumulated in plastic bags, transported to and stored in the radwaste building prior to shipment to an offsite processor for incineration or supercompaction.

Filter media may also be stored in onsite shielded liner storage modules, designed specifically for the purpose of temporary storage prior to disposal. These containers have been analyzed and designed to withstand the elements without additional shelter, including seismic, winds and floods.

Dismantled systems and other non-compactable solids with relatively minor levels of contamination may be stored temporarily at other than the previously described locations, as approved by Radiation Protection. Examples of locations expected to be used from time to time during dismantlement include the Reactor Building, the Turbine Building laydown area, the Contaminated Equipment Warehouse, and various boundaried and posted outside areas, subject to ensure against environmental release of radioactivity and maintaining worker safety.

11.4.3 RADIOACTIVE SHIPMENTS

An estimate of the solid waste classification during dismantlement for off-site disposal is presented in Table 11-3.

TABLE 11-3
DECOMMISSIONING WASTE CLASSIFICATION AND VOLUME PROJECTIONS

Commodity	10-CFR-61 Classification	Burial Volume (cubic feet)
Asbestos Insulation Removal	A	2800
Nuclear Steam Supply System	A	8200
Nuclear Steam Supply System	B	390
Nuclear Steam Supply System	C	530
Reactor Cavity	A	4200
Electrical	A	6300
Miscellaneous Structures & Systems	A	11700
Main Steam System	A	620
Stored Resins	B	1900
Condensate System	A	4200
Shutdown Cooling System	A	3200
Structures Inside Containment	A	5300
Main condenser	A	750
Feedwater System	A	2500
Turbine	A	540
Spent Resins & Filters	B	2100
Heating and Ventilation	A	2500
Reactor cooling Water System	A	1800
Stored Dry Active Waste	A	8400
Stored Filters	A	1000
Structures Outside Containment	A	2200
Hardware Stored in Fuel Pool	A	520
Hardware Stored in Fuel Pool	C	230
Hardware Stored in Feel Pool	>C	*
TOTAL		72104

* Reference Federal Register Notice 10/11/2001 (66 FR 51823). Effective November 13, 2001, interim storage of Greater than Class C (GTCC) waste was maintained under federal jurisdiction and is stored in a manner consistent with current licensing for the interim storage of spent fuel.

11.4.4 BULK MATERIALS CONTROL PROGRAM

Big Rock Point established a program for the removal of bulk materials originating from demolition activities associated with the decommissioning of the facility under the provisions of 10 CFR Part 20.2002. The NRC granted approval of the request for an alternate waste disposal method on February 5, 2002. Under the provisions of this approved request, Big Rock Point is authorized to dispose of demolition debris with trace amounts of NRC licensed radioactive material in a State of Michigan licensed Type II landfill. The program is technically supported by the Administrative and Implementing procedures, which define the methodology and the technical basis for implementation of the program.

The trace concentration of NRC licensed radioactive material in the demolition debris is bounded by a total principal gamma emitter concentration value of 5pCi/gm. This limit will ensure that radiological dose to workers and members of the public is kept As Low As Reasonably Achievable. The NRC staff concluded that disposal of demolition debris under these conditions in a State of Michigan licensed Type II landfill will result in a calculated potential annual dose to a worker or a member of the public of less than 1 mrem. This calculated dose is well within the 10 CFR Part 20 annual dose limit of 100 mrem and less than the annual dose limit of 25 mrem for decommissioning, which will allow for license termination and unrestricted use of the land.

11.5 AREA, PROCESS AND EFFLUENT MONITORING AND SAMPLING SYSTEMS

The area, process and effluent monitoring systems installed at Big Rock Point provide indications of the presence of radiation and radioactive material in areas, ventilation and liquid streams. Monitors are provided to measure radiation fields and the presence of radioactive materials for normal operations and under accident conditions.

11.5.1 DESIGN BASES

The area monitoring system detects, indicates and records gamma radiation in selected areas throughout the plant primarily for personnel protection. The two spent fuel pool area monitors, utilized as criticality monitors, provide an automatic closure signal to the containment building ventilation valves (reference Section 6.2.4 of this Updated FHSR), when either of their setpoints are exceeded. Their setpoints have been established between 5 and 20 mrem/hr in accordance with 10 CFR 70.24. CPCo letter dated October 2, 1973 requested an exemption from the requirements of 10 CFR 70.24 which permits temporarily raising the alarm set points on these monitors above the 20 mrem/hr allowed. The exemption was granted by the Atomic Energy Commission (AEC) by letter dated February 26, 1974. Operability requirements are addressed in the Defueled Technical Specifications, and Offsite Dose Calculation Manual (ODCM). The area monitoring system includes alarms and indications in the monitoring station . Warning and high radiation alarms, and a failure alarm, are provided for each area monitor.

Portable and telemetered instrumentation, rather than the fixed area monitor locations utilized during the plant operating phase, normally will be used for monitoring of work areas during dismantlement. Fixed area monitors will continue to be utilized only where specified by Defueled Technical Specifications (see spent fuel pool area monitor, above). Use of portable and telemetered instrumentation for personnel protection purposes allows location in the immediate proximity of work, or at locations best able to detect changes in radiation fields due to work processes.

The process monitoring system detects, indicates and records levels of radioactive materials in plant liquid and gaseous effluent streams. The system is designed to be able to detect radioactive materials in effluents below the limits of the ODCM. The system includes warning and/or high alarm indication in the monitoring station when a predetermined level is exceeded. The operable range for each monitor is chosen to correspond to the expected level of radioactive material in each stream. Table 11-4 identifies each monitor, current location, range and function.

Radiation monitor locations, sensor types and range characteristics will vary as dismantlement proceeds. For example, the predominant noble gas becomes Kr-85 (predominantly a beta emitter) as the shorter lived gases decay away, and the radionuclides Co-60 and Cs-137 become dominant in effluents and as plant radiation sources. In addition, radiation levels and radionuclide concentrations are reduced with time due to decay, thus negating the need for the upper ranges of instrument response required during power operation.

The design and construction of the area and process monitoring systems is consistent with the Uniform Building Code which includes a specification for a 0.025g static horizontal load. The containment and ventilation stack accident monitors were designed and constructed to the seismic classification of USNRC Regulatory Guide 1.60.

Table 11-4
PROCESS MONITORING SYSTEM

Detector Element	Detector Location and Function	Monitor Type	Range	Action When Set Point Exceeded
RE-8292	Stack Gas Monitor on sample line from stack (Noble Gas)	Beta Scintillation	$10^2 - 10^7$ cpm	Alarm
RE-8293	Stack Gas Monitor on sample line from stack (Particulate)	Beta Scintillation	$10^1 - 10^6$ cpm	Alarm
RE-8291	Radioactive Waste Effluent to Discharge Canal in Liquid Radwaste Valve Gallery	Scintillation	$10^1 - 10^7$ cpm	Alarm
RE-8289	Canal Discharge in the Lower Level of the Screen House	Scintillation	$10^1 - 10^7$ cpm	Alarm

11.5.2 SYSTEM DESCRIPTION

The Stack Gas Monitoring System (depicted on Drawings 0740G40108 Sheets 1 and 2), also called the Particulate Iodine Noble Gas (PING), receives a representative isokinetic sample of plant gaseous effluent from the plant stack. The sample is monitored for particulates by a beta scintillation detector and laboratory analysis, and noble gases by a beta scintillation detector. Controls, indication, and recorders are located in the monitoring station and at the main equipment skid.

Sample air flow is provided by a 100% capacity vane (4 total) vacuum pump mounted on the main equipment skid. The pump is rated for 4.0 scfm.

The particulate filter is sized to handle airflow of 5 scfm maximum, 3.1 ± 0.3 scfm nominal.

The beta scintillation detector is located to monitor activity of the particulate filter. The detector readout in the monitoring station contains a high radiation alarm point and an equipment failure alarm point. The equipment failure alarm can be triggered by loss of power, circuit failure, detector failure, or low background noise.

The noble gas scintillation chamber beta detector has an indication range of 10^2 to 10^7 cpm. High radiation and equipment failure alarms are provided with the scintillation chamber beta detector readout located in the monitoring station. The high radiation setpoint is adjustable and located internal to the readout on the main equipment skid. The high alarm is normally set at approximately 1×10^4 cpm, which is less than 10 CFR 50 Appendix I criteria. Trip test pushbuttons, internal to the readout, allow test of the alarm and control functions. The equipment failure alarm can be triggered by loss of power, circuit failure, detector failure, or low background noise.

The isokinetic sample nozzles in the plant vent stack are used for the gaseous effluent monitoring system. The sample is drawn through two half inch stainless steel tubing runs down the outside of the stack to the equipment skid location where the two lines combine into one 3/4 inch line. An isokinetic probe heater prevents freezing of the sample nozzles.

The sample flow tubing is heat traced and insulated from the isokinetic nozzle to the point it is no longer exposed to the outdoor environment. Each line has a redundant heat tape installed in case of failure, The tapes are powered through a control box in the stack base.

System pressure is indicated at the sample pump inlet. A pressure switch also provides indication of a high inlet vacuum condition by illuminating a yellow light on the monitor chassis.

A flow indicator, and flow controller are located on the main equipment skid and control the sample flow rate through the system at 3.1 ± 0.3 cfm, nominal.

The Process Liquid Monitor System, employing gamma scintillation detector channels, is provided to give indication of radioactivity trends in process liquid streams normally containing radioactive liquids.

Liquid process streams shall be monitored in accordance with the Off-site Dose Calculation Manual. The following process streams are currently being monitored:

A. Radioactive Waste System Effluent to Canal
B. Canal Water Discharge

Monitor alarms are set so as to warn the monitoring station operator when concentrations are present which exceed predetermined levels corresponding to ODCM limits. The alarm setpoints for B and C are normally set to detect permissible effluent concentration from 10 CFR 20. The radioactive waste system effluent to canal monitor is capable of detecting 5×10^{-5} μCi/ml of Cs-137.

Monitors for the two (2) process liquid streams are of the fixed gamma type consisting of a scintillation detector mounted in a lead-lined stainless steel pig, a high-voltage power supply and a Linear Count Rate Meter (LCRM).

<u>Drawing 0740G44021</u> provides a schematic diagram of each process monitoring system.

In the event of a failure of the normal power source to either or both the area and process monitoring systems, electrical power is supplied through a separate feed from the on-site diesel generator.

11.6 DISCHARGE CANAL DREDGING MANAGEMENT

On August 31, 1990 the Commission issued a Safety Evaluation related to Consumers Energy Company's application for disposal of dredged discharge canal sediment. The staff found that, pursuant to 10 CFR 20.302, the proposed procedures were acceptable. The dredging will involve relocating between 250 and 500 cubic yards of sediment with an estimated activity of 0.9 μCi from the discharge canal to a confined disposal area above the high watermark (580.8 ft).

Confirmatory measurements of the dredged material will be made by Consumers Energy after it is land-spread. If the levels of radioactivity measured in the preoperational sediment samples were significant underestimates (greater than 25%) of the actual radioactivity of the dredging spoils, Consumers Energy will notify the NRC.

Big Rock Point may dredge the canal annually thereafter for a 10 year period. As of August 31, 2000, dredging approval expired. The following commitments, made prior to each dredging, are listed below:

1. Radionuclide concentrations and environmental exposure pathway doses will be evaluated in the same manner as that described in the original application dated December 29, 1989.

2. Compare evaluated doses with the NRC staff guidelines for onsite disposals listed in Section 4.0 of the NRC Safety Evaluation identified above.

3. If the guidelines cannot be met, the disposal of the particular dredging shall be deemed to be outside the scope of the original application, and a reapplication to the NRC shall be made for the dredging in question or alternative disposal method pursued.

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The ALARA program required by the Radiation Safety Program and amplified by plant procedures is graded in nature requiring increasingly higher levels of prework review in proportion to the anticipated level of radiation dose on any particular task. Check lists exist to insure prework planning, activity execution and post job debriefing are accomplished where appropriate so that doses are kept ALARA and that the experience gained can be incorporated in future similar activities.

In addition, access to high and very high radiation areas are controlled through administrative procedures and postings at the areas. Certain high and very high radiation areas may also be locked.

Persons not qualified to monitor for the presence and amount of radiation are not permitted to enter any high or very high radiation area unless accompanied by a person qualified in Radiation Protection procedures.

Administrative Procedures require all new procedures involving work within a radiologically controlled area to have an ALARA review.

All work in radiation areas and all entries to high radiation contamination, and airborne areas requires the use of a Radiation Work Permit (RWP). The RWP specifies the radiation protection requirements for the job and incorporates ALARA philosophy and knowledge from past similar jobs. Each worker is responsible for following the requirements of the RWP and minimizing their radiation dose to the maximum extent practicable. They are also obligated to inform radiation protection personnel when a specific activity is not ALARA.

12.1 ENSURING OCCUPATIONAL ALARA

The Big Rock Point Nuclear Plant radiation safety program is based upon the presumption that any exposure to ionizing radiation involves some risk. As a result part of the normal work process involving people in radiation controlled areas is to ensure that the Total Effective Dose Equivalent (TEDE) is kept as low as reasonably achievable (ALARA).

12.1.1 POLICY CONSIDERATIONS

The Policy of Consumers Energy, and that of the Big Rock Point Nuclear Plant is to present a radiation safety program which controls radiation dose (external and internal) in a manner that avoids unnecessary and accidental doses, maintains doses to workers within regulatory limits and assures that doses to workers remain as low as reasonably achievable (ALARA).

The organizational structure for conducting the Radiation Safety Program and minimum qualifications of the individuals occupying positions within that structure are defined in Section 12.5.1 of this Chapter, Chapter 13 of this UFHSR, and in plant administrative procedures. Responsibilities of management and individual workers in carrying out the policy of ALARA are defined in the Radiation Safety Program. The Radiation Safety Program, as contained in plant procedures, provides requirements and guidance to the plant in all areas of radiation protection. In addition to responsibilities the plan contains standards relating to management policy, radiation safety training, dose control, contamination control, surveys, instrumentation and incident investigation and analysis.

Policy guidance in Regulatory Guide, 1.8 relating to personnel selection and training, has been incorporated into Consumers Energy Human Resources Department policies.

The guidance of Section C.1 of Regulatory Guides 8.8 on ALARA and 8.10 on the Occupational Radiation Safety Program have been incorporated in the aforementioned radiation safety program.

12.1.2 DESIGN CONSIDERATIONS

Design considerations for the Big Rock Point Plant to maintain the TEDE ALARA include: 1) shielding for radioactive components and systems; 2) location of equipment controls in low radiological dose areas; and 3) equipment design to allow quick maintenance in higher radiation dose areas.

Shielding for components and equipment containing radioactive material is based upon the existence of penetrating radiations from the fuel while stored in the spent fuel pool. In addition, other sources of radiation considered in the plant shielding design are the energetic gamma rays from neutron capture activation products of the reactor materials and impurities in the primary coolant.

SC 96-022 replaced a portion of the buried concrete encased resin sluicing lines from the cleanup, condensate and radwaste demineralizers with above grade pipes in a welded steel trough. The trough is shielded with concrete on the sides and steel on top.

Remote equipment controls exist for the condensate demineralizers, liquid radioactive waste, and reactor cleanup systems. Certain turbine and condenser valves and controls have also been positioned outside of the condensate and feedwater train shield, and manual operation of some major valves in the recirculation pump room can also be accomplished outside the shield wall.

All facility changes in radiologically controlled areas require review to assure that doses are kept ALARA. This review is usually performed by the ALARA coordinator in the plant's radiation protection organization.

12.1.3 OPERATIONAL CONSIDERATIONS

Decommissioning considerations for the Big Rock Point Plant to maintain radiation doses ALARA include: 1) a program to keep as much of the plant as radiologically clean as reasonably possible; 2) an ALARA program requiring advance planning and the use of dose reduction techniques for all work involving significant radiation exposure; 3) an ongoing training program to insure that individuals entering and working in radiologically controlled areas can keep their dose ALARA, 4) periodic procedure and work practice reviews to reduce doses further, and 5) a radiation job history file to trend performance and document/retrieve past experience.

Periodic contamination surveys required by plant procedures coupled with quick clean-up of measured contamination and frequent observations of plant equipment to discover and fix leaks quickly has resulted in most of the plant areas remaining free of measurable amounts of removable radioactive material. Normally areas within the containment building with the exception of: 1) the area within the shield containing the steam drum, recirculating water pumps, associated lines and valves, shutdown heat exchangers, and control rod drives; 2) a small work area specifically designated for storage of and maintenance on contaminated equipment; and 3) localized areas near a few specific pieces of equipment, remain radiologically clean. In the turbine building the areas normally exhibiting surface contamination are: 1) the area within the shield walls containing the condensate and feedwater train; 2) a room adjacent to the machine shop specifically designated for storage of and maintenance on contaminated equipment; 3) the valve and pump gallery and tank area of the liquid radioactive waste system, and 4) local areas around a few specific pieces of equipment. In the solid radioactive waste packaging and storage building a few localized areas specifically designated for accumulation and storage of unpackaged solid waste are contaminated. The remainder of the plant remains uncontaminated permitting much maintenance and most routine observations, inspections and operational activities to be performed in customary street clothing.

The areas described above represent a practical minimum for contaminated areas within the plant, and are based upon over 35 years of operation of the facility. During plant decommissioning temporary expansion of contaminated areas occurs.

12.2 RADIATION SOURCES

The radiation sources that are the basis for the original radiation protection design of the Big Rock Point Plant and those that have been experienced during the operational history of the plant today are described below.

12.2.1 CONTAINED SOURCES

For the major components and lines of the primary coolant system, the controlling radionuclide that dictated the shielding thickness during reactor operation was nitrogen-16.

Except for the spent fuel pool, shielding for other areas of the plant including the turbine, its auxiliaries, condensate and feedwater train and the radioactive waste processing systems was based upon a combination of corrosion and fission products in the primary coolant during shutdown of up to 6 microcuries per milliliter. This level was developed from an early assumption of 1000 leaking fuel rods.

Shielding for the control room was based upon the occurrence of the maximum credible accident resulting in a release of 100% of the core noble gases, 50% of the halogens (I, Br), 15% of the volatile solids (Te, Se, Ru and Cs) and 0.3% of all other fission products to the containment.

The concrete structure of the Spent Fuel Pool and the water in the pool provide sufficient shielding from the spent fuel to reduce the radiation dose rates at the water's surface and at the exterior walls to acceptable levels. At one location on the south wall its thickness tapers to accommodate storage of the spent fuel transfer cask. Storage of spent fuel in the pool immediately adjacent to the tapered portion of the south wall is not permitted until such fuel has been out of the reactor for at least one year.

The handling and storage of radioactive sealed sources is controlled by the Chemistry and Health Physics Department.

12.2.2 AIRBORNE SOURCES

During decommissioning, fuel movement and the venting of any system containing radioactive materials may result in temporary airborne sources of radioactive materials. Occupational dose control through monitoring, ventilation and other processes is performed. Respiratory protection is used only when engineering and other controls are not practical to reduce airborne concentrations to less than 0.3 Derived Air Concentration (DAC) and when use of respiratory protection is necessary to maintain TEDE ALARA. The plant was designed with both the reactor coolant loop as well as the condensate and feedwater trains within concrete enclosures vented to the plant stack. As a result airborne radioactive material of notable concentrations have been virtually non-existent in normally or occasionally occupied areas.

12.3 RADIATION PROTECTION DESIGN FEATURES

The Big Rock Point Plant incorporates both design features and procedural controls to minimize occupational dose to radiation.

12.3.1 FACILITY DESIGN FEATURES

Two primary radiation dose reduction design features were incorporated in the plant. All major components and interconnecting lines carrying or containing radioactive material are contained in shielded enclosures. Valves, instruments and controls for many of these components were placed outside the shielded enclosures to permit observation, operation, and some maintenance without entering the more highly radioactive areas within the shielded enclosures. Specifically, pumps, valves, and the control center to operate the liquid radioactive waste system have been placed outside the tank room. Control panel and remote valve operators for the cleanup system demineralizer, remote valve operators for the primary coolant recirculation pumps and condenser air ejectors, and a remote control panel for the condensate demineralizers were placed outside their respective shielded enclosures. In addition, instrumentation for much of the plant equipment has been placed outside of the shields.

Contamination control is maintained by routine surveys to ensure that as much of the radiologically controlled area is as clean as practicable. Contaminated areas above 1000 dpm/100cm^2 (removable) are posted as such or cleaned. In no event are personnel allowed to leave the radiologically controlled area with contamination greater than 5000 dpm/100cm^2 (fixed and/or removable) on their person without authorization of designated Health Physics personnel.

Regulatory position C.2 of Regulatory Guide 8.8 has generally been followed in the design of the plant. Specifically:

a. Access Control of Radiation Areas

Access is controlled to radiologically controlled areas by means of radiation work permits or by individuals specifically trained in radiation protection procedures. Measurement of radiological conditions throughout the plant are made periodically. Changes in the status of any particular area are noted on the periodic surveys. Specific areas evaluated by radiation protection personnel will have a radiological status sheet posted for the area providing the radiological data for the area.

Access to high radiation and very high radiation areas are additionally controlled through administrative procedural requirements. High radiation areas are generally confined to locations behind shield walls.

The movement of large sources of radiation throughout the plant is normally accomplished by the use of shielding and/or planned to minimize dose to personnel.

b. Radiation Shields and Geometry

Shielding to reduce radiation doses have been designed based upon the assumptions described in section 12.2.1. Shield thickness for various pieces of equipment are described further in section 12.3.2. Cubicles for individual pieces of equipment have generally not been provided. Sumps (turbine and containment) and lines to transmit radioactive water are all located within shielded enclosures or imbedded in concrete.

c. Process Instrumentation and Controls

Process instrumentation and controls have been generally located outside of shielded enclosures. Some valves used to operate the condensate demineralizers are located within its shielded enclosure but contain local shields to reduce dose to operating personnel.

d. Control of Airborne Contaminants and Gaseous Radiation Sources

Engineering control and ventilation flows are used to routinely reduce airborne contaminants. The use of respiratory protection to reduce dose is provided but used only when other methods are not practical and the use of respiratory protection is necessary to maintain TEDE ALARA. Section 12.2.2 and Chapter 11 describe further the policy and design of the facility to reduce exposure to airborne sources.

e. Crud Control

The original design of the Big Rock Point Plant utilized admiralty metal in the feedwater heaters and reactor clean-up system heat exchangers. Heat exchanger tubes in these systems were replaced with stainless steel to reduce crud production and subsequent activation. With the exception of the zircaloy fuel cladding, the interior surface of the primary coolant system consisted of stainless steel alloys.

The production of activation products, particularly Co-58 and Co-60, as a result of using stainless steel exists but has been kept moderately low. Use of low cobalt materials in equipment/component replacements were considered to the maximum extent practicable when these materials were available and based on good engineering judgement. Oxygen control in the primary coolant, the use of full flow condensate demineralizers and use of the reactor clean-up system have also aided in the reduction of concentrations of these and other impurities in the primary coolant.

Crud traps were not specifically minimized in the original plant design. Several existed and their removal was not practical during the plant's operational life. An important ALARA objective for plant decommissioning is early action to eliminate or shield such locations to minimize worker exposures during dismantlement activities.

f. Isolation and Decontamination

Much of the plant equipment and interconnecting piping was not originally designed for ease of decontamination to reduce radiation fields in areas that may be occupied. However, subsequent to final plant shutdown and defueling, chemical decontamination of the reactor coolant, shutdown cooling and reactor cleanup systems was performed. General area dose rate reductions of approximately a factor of 10 were achieved. Chemical decontamination was effective both in reducing worker doses during dismantlement activities and as an engineering control for minimization of airborne exposures due to removal of more than 90% of the plant's source term of crud available for becoming airborne during system dismantlement.

g. Radiation Monitoring Systems

The area and process monitoring systems installed at the plant are described in detail in Chapter 11.

h. Resin and Sludge Treatment Systems

Demineralizer systems whose resins become radioactive are used as necessary. Resins whose ion exchange capacity is exhausted may be sluiced to a shielded HIC, as described in this section, for ultimate disposal as solid radioactive waste.

SC 96-022 replaced a portion of the buried concrete encased demineralizer resin sluice lines with above grade lines in a welded steel trough. The trough is shielded with concrete on the sides and steel on the top.

SC 96-022 also added high level alarms to the resin disposal tank.

MA-98-033 replaced the demineralizer and added redundant filters to the Rad Waste System. The process lines are directed from the radwaste pump room to the condensate pump room via the outside radwaste pump room access. The outside lines are double walled, sloped and heat traced. The 13 ft. span is located within an existing radiological controlled area (e.g., Zone 1A).

MA-99-0065 installed a shielded High Integrity Container (HIC) in the east end of the former condenser area and a line to sluice spent resins from the replacement radioactive waste demineralizer to the HIC. This minor alteration eliminated sluicing resins to the disposal tank and later pumping resins from the radwaste tank to a HIC for off-site disposal. This minor alteration retired in place the resin disposal tank, the resin disposal tank high level alarm, and the above-grade resin sluice lines.

Filter systems within the plant for liquid streams are either of the cartridge or sock strainer type. Backwashing is not practiced so sludge material is not transferred through piping systems. Cartridges and sock strainers are removed, placed in shielded casks then transported to the solid radioactive waste area for ultimate off-site disposal.

12.3.2 SHIELDING

Shield arrangement and thickness for the plant are shown on Drawings 0740G40100 through 0740G40104 inclusive. The design of the original plant shielding was based on the assumption that the maximum permissible dose rate is five rems per year. The target weekly dose rate limit is taken as 100 mrems/week. In carrying out the above, the following maximum dose rates were established for the designated areas indicated on Drawing 0740G10052 as applicable to the plant operating phase.

Zone I	Areas where access is not controlled: 0.5 mrem/hr. Such areas include the Control Room and adjacent areas, and outside areas around the process buildings. Thus, exposure in such areas for a 40-hour week will not contribute more than 20% of the working limit dosage of 100 mrems and probably will average less than 10%. This will reserve most of the permissible radiation dose of plant personnel for radiation zone entry.
Zone IA	Same as Zone I except access is controlled.
Zone II	In certain cases where extended occupancy may occasionally be required: 1.5 mrem/hr.
Zone III	Reactor Enclosure and Turbine Building areas requiring periodic entry for sampling, inspection, auxiliary equipment maintenance, etc.: 15 mrem/hr.
Zone IV	Infrequently entered areas: over 15 mrem/hr.

Ordinary concrete has been used almost exclusively for shielding of the primary system and auxiliary systems which contain radioactive material. A small amount of heavy concrete is used in the shield wall around the turbine because of space limitations, and lead jackets have been placed around the condensate demineralizers and their sluice and transfer lines in order to minimize the number of remote valve operators.

The above grade resin sluice piping installed by SC 96-022 is shielded with a combination of concrete and steel.

Shield thicknesses for the major shields within the plant are shown in Table 12-1.

Table 12-1
Location, Material and Thicknesses of Major Shields

Equipment Shielded	Material	Thickness
Liquid Radioactive Waste Tanks	Poured Concrete	3 Feet (Walls)
Liquid Radioactive Waste Sock Filter	Poured Concrete	2 Feet
Resin Disposal Tank	Poured Concrete	3 Feet
Liquid Radioactive Waste Demineralizer	Solid Concrete Block	4 Feet
Liquid Radioactive Waste Cartridge Filter	Steel	¼ Inch
Condensate Demineralizers	Poured Concrete	1.5-2 Feet
Main Condenser and Condensate/Feedwater Pipe Tunnel	Poured Concrete	2.5-3 Feet
Turbine and Moisture Separator	Poured Heavy Concrete	2 Feet
Recirculating Pump Room and Steam Drum Enclosure	Poured Concrete	3-4 Feet Walls 6 Feet Ceiling
Reactor Vessel	Poured Concrete	7 Feet Minimum *
Shutdown Heat Exchanger Room	Poured Concrete	2 Feet
Spent Fuel Pool Filter		1.5 Feet (Wall Only)
Spent Fuel Pool Floor	Lead and Poured Concrete	1 Inch 6 Feet
Walls	Poured Concrete	5-6 Feet (South Wall Taper 3.5 Feet Min)
	Steel Liner	3/16 Inch
Above Grade Resin Sluice Lines	Sides – Poured Concrete Top – Steel Plates	15 Inches 5 Inches
Alternate Liquid Rad Waste Demineralizer	Steel Concrete	3 Inches 9 ½ Inches
Alternate Liquid Rad Waste Pre-Filters	Lead or Bismuth	6" Lead effectiveness
Alternate Liquid Rad Waste Post Filters	Steel	2 Inches
Alternate Liquid Rad Waste Process Lines (incl. Liquid & Resin)	Lead Blankets	As conditions warrant

* As a result of FC-708, there will be no concrete shielding at elevation 616'-0" on the west side of the reactor cavity. Measures will be taken, as necessary, to reduce general area dose rates and control access.

12.3.3 VENTILATION

The plant ventilation system is described in Chapter 9 and further discussed in Chapter 11 in relation to gaseous waste management.

12.3.4 AREA AND AIRBORNE RADIATION MONITORING INSTRUMENTATION

The area radiation monitoring system, including the Spent Fuel Pool criticality monitor, is described in Chapter 11. Monitoring for airborne radiation is accomplished by the use of grab samples followed by laboratory analysis. Specific particulate nuclide concentrations may also be measured by portable filter samplers with subsequent laboratory analysis.

12.4 DOSE ASSESSMENT

The 30+ years operating history of the plant has provided considerable information on actual occupational radiation doses received. Table 12-2 shows the annual collective total person rem doses since the plant began operation through 2000.

Personnel monitoring is provided by using thermoluminescent dosimetry (TLD) as the primary external dose measurement. Electronic dosimetry or pocket ionization chambers may be utilized for secondary measurement. The primary dosimetry is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP). Internal radiation dose assessment is provided through DAC-hour tracking by the use of air samples and respiratory protection (as appropriate) or by whole body counts. Whole body counting is the primary method of bioassay and is used to verify intakes of radioactive material are ALARA and to provide a measure of effectiveness for the respiratory protection program.

TABLE 12-2
Big Rock Point Annual Occupational Radiation Doses
(Person Rem)

Year	Radiation Dose Person Rem[1]	Average Dose Rem/Person[2]	Unusual Circumstances
1962	1.4		
1963	16		
1964	50		
1965	88		
1966	220		First Large Fuel Clad Failure
1967	150		
1968	177		
1969	136	0.82	
1970	194	0.67	
1971	184	0.70	
1972	181	0.92	
1973	336	(3)	
1974	276	0.98	
1975	180	0.83	
1976	270	0.54	RDS AND ISI Program Added

TABLE 12-2 Big Rock Point Annual Occupational Radiation Doses (Person Rem)			
Year	Radiation Dose Person Rem[1]	Average Dose Rem/Person[2]	Unusual Circumstances
1977	306	0.62	Significant Additional ISI Conducted
1978	165	0.38	No Refueling Outage
1979	377	0.60	Significant RVI Work and CRD F-2 Repair
1980	338	0.52	
1981	134	0.24	
1982	300	0.46	
1983	247	0.43	
1984	121	0.30	
1985	283	0.49	10CFR50 App R Modifications
1986	75	0.22	No Refueling Outage
1987	211	0.50	
1988	156	0.36	
1989	160	0.34	
1990	221	0.51	
1991	216	0.46	
1992	262	0.50	
1993	153	0.29	
1994	119	0.26	
1995	55	0.17	
1996	208	0.39	
1997	55	0.10	
1998	104	0.16	

TABLE 12-2 Big Rock Point Annual Occupational Radiation Doses (Person Rem)			
Year	Radiation Dose Person Rem[1]	Average Dose Rem/Person[2]	Unusual Circumstances
1999	87	0.18	
2000	89	0.23	

1) Doses listed from 1962 through 1968 are for Big Rock Point Plant employees only. The total consumers Energy non-plant staff dose for this time period is 177 person rem. The total contractor dose for these years is 81 person rem.

2) Staff size and total people badged from 1962 through 1968 is not readily available so average dose is not readily available.

3) Data to calculate average not readily available.

12.5 HEALTH PHYSICS PROGRAM

12.5.1 ORGANIZATION

In addition to the positions described in Section 13.1, the Health Physics Organization also consists of an ALARA Coordinator whose responsibility is review/evaluation of activities and procedures with regard to dose reduction, and a supervisor in charge of routine radiation protection activities, supervision of radiation protection technicians, radiation instruments and surveys.

Other personnel with specialized training in radioactive waste disposal are maintained for the shipment of radioactive material.

12.5.2 EQUIPMENT, INSTRUMENTATION, AND FACILITIES

Portable radiation measuring instrumentation has been selected to adequately measure routine and accident conditions considering expected ranges of dose rates and radionuclide mixtures. Adequate supplies are on hand to cover normal operations to meet the requirements of 10 CFR, Part 20, "Standards For Protection Against Radiation." Most of the portable radiation measuring instruments are stored in Access Control, readily available for use by qualified personnel. Several instruments may also be stored at various locations in the plant for operational convenience. Portable gamma and neutron measuring instruments are calibrated semi-annually and functionally checked on a routine basis. Most instruments are serviced onsite.

Redundant germanium gamma spectroscopy equipment is onsite to identify radionuclides and mixtures for compliance with 10 CFR, Part 20 and to meet industry standard lower levels of detection. Other laboratory equipment such as proportional counters, well detector and Geiger muller counters are available for other various types of analyses.

Instrument calibrations traceable to the National Bureau of Standards (NBS) are accomplished by a Cesium-137 well source or JLShepherd Model 89, Cesium-137 irradiator or NBS traceable liquids purchased from various suppliers. Some calibrations may also be performed using sources quantified with onsite gamma spectroscopy systems.

Access Control is located at the boundary of the radiologically controlled area and contains a shower and sink for decontamination purposes, hand-held contamination monitors, some radiation instruments (ion chamber type) and high sensitivity whole body friskers. A radiation protection technician work area is located adjacent to Access Control to allow ready observation of egress activities. Secondary access control points may be established at other locations. Control points are equipped and/or staffed to a level commensurate the work being controlled.

Respiratory protective equipment and anticontamination clothing is stored onsite. Different sizes of respirators and clothing are maintained to fit virtually all personnel and quantities are sufficient for routine and emergent work.

The respiratory protection program also includes quantitative respirator fit test equipment and a scanning whole body counter for bioassay measurements. A decontamination sink with automatic washer is provided for respirators.

12.5.3 PROCEDURES

The Health Physics Program includes but is not limited to the following program areas: Radiation protection, ALARA, Dosimetry, Radiation Work Permits, Respiratory Protection, Instrumentation, Chemistry, Training and Radioactive Waste. Administrative and working level procedures are provided for these program areas. These procedures incorporate regulatory, license, and Technical Specification requirements. These procedures also incorporate Consumers Energy corporate policy and requirements.

Radiation Protection procedures are generally written to cover those activities described in Regulatory Guide 1.33.

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13.5 PLANT PROCEDURES

13.5.1 ADMINISTRATIVE PROCEDURES

13.5.1.1 Conformance With Regulatory Guide 1.33 - Quality Program Requirements (Operation)

Consumers Energy complies with the regulatory position of Regulatory Guide 1.33 - (2/78, Revision 2) as modified by the exceptions stated in the Consumers Energy Quality Program Description for Nuclear Power Plants, CPC-2A, which provides Policy and Implementation requirements for instructions, procedures and drawings.

13.5.1.2 Administrative Control Requirements and Standards

Activities affecting the quality of structures, systems, and components required for the safe storage of spent fuel and for providing radiological control are accomplished using instructions, procedures and drawings appropriate to the circumstance which include acceptance criteria for determining if an activity has been satisfactorily completed.

13.5.1.3 Measures To Be Taken Following Incidents

To prevent or limit adverse consequences following incidents, the corrective action process requires:

a. Initiation of immediate corrective action to ensure the safety of plant personnel and the public.

b. Notification of the NRC in accordance with plant procedures and NRC regulations.

c. Investigation of the condition and establishment of any corrective actions necessary to resolve the condition and prevent recurrence.

13.5.1.4 Administrative Procedural Controls

Plant procedures provide requirements for use and control of procedures as well as processing new procedures, revisions and editorial changes to procedures, temporary procedures and procedure cancellations. is provided in plant procedures. The procedures program provides instructions that apply to those procedures required by the Consumers Energy Quality Program Description for Nuclear Power Plants, CPC-2A, and those not required by CPC-2A. The procedures program identifies responsibilities of management, preparers, reviewers and document control and encompasses both operational and dismantlement activities. It provides for the review of safety implications in accordance with 10 CFR 50.59 for the review of decommissioning activities in accordance with 10 CFR 50.82(a)(6), and for the review of safety implications in accordance with 10 CFR 72.48 for the ISFSI facility and storage cask system.

Plant procedures provide for identification of procedures developed for decommissioning.

Plant procedures and procedure revisions are approved by the Site General Manager prior to use.

Plant procedures are reviewed periodically as described in plant procedures.

The Department Head approves all working level procedures prior to their issuance.

The Safety Review Committee (SRC) reviews procedures and revisions to those procedures that affect nuclear safety to ensure that an unreviewed safety question does not exist. This body makes recommendations to the Site General Manager as to whether the procedure should be approved.

Plant procedures will be filed in the Plant's document control center for periods of time consistent with guidance given in the Consumers Energy Quality Program Description for Nuclear Power Plants, CPC-2A.

13.5.1.5 Decommissioning Work Package Process

The Construction Department performs work in accordance with plant administrative procedures. A Decommissioning Work Package (DWP) process is provided to control the identification, planning, performance and documentation of dismantlement of areas, systems, structures and components. The DWP process does not apply to corrective or preventive maintenance and is not used to develop a DWP which would modify or remove safety related systems structures or components.

13.5.2 PLANT OPERATING PROCEDURES

This section describes the Big Rock Point plant operating procedures, which include procedural operating safeguards to be established, the procedures for normal operation, and the plans for handling emergency situations which may arise in the operation of the plant.

13.5.2.1 Basic Operating Principles

With the Plant decommissioned, a monitoring station (reference FC-695) was installed to allow abandoning the control room. The monitoring station is equipped with controls for the plant sirens and the containment ventilation valves. Redundant computers provide indications and annunciation for abnormal releases of radioactivity to the environment. SFP area radiation, water level and temperature, and failure of the main diesel generator or the fire pumps.

Shift crew composition is outlined in Section 13.1.5 and Section 13.5.2.9 of this Updated FHSR.

Most operating functions are performed at local control panels and stations outside of the monitoring station but only at the direction of, or with prior knowledge of, the operator in the monitoring station.

Operations will be performed in accordance with specific procedures.

Surveillance tests and routine preventive maintenance of protective devices and critical operating equipment will be done in accordance with established schedules.

Personnel leaving controlled radiation areas and equipment being removed from such areas will be surveyed to an extent adequate for control of contamination.

Irradiated fuel is to be handled by semi-remote methods, ie, using long grappling poles through water and a shielded transfer cask.

Containment closure, ventilation and air filtration requirements are discussed in Chapter 6 of this UFHSR.

Operation of the radioactive waste handling system will be such as to assure that the disposal of radioactive materials will not result in the exposure of any persons on or off the plant site to radiation in excess of permissible limits. These operations will be performed in accordance with NRC regulations (10 CFR Part 20). Most liquid wastes are handled in discrete batches to facilitate control. Most gaseous and airborne wastes are monitored and discharged from a high stack to facilitate atmospheric diffusion. Solid wastes are stored in underground vaults, tanks within the plant, shielded containers outside the plant or various satellite on site storage facilities.

Incidents, unsafe acts, and excessive exposures to radiation will be investigated to effect procedures to prevent recurrence.

13.5.2.2 Description of Operating Procedures

Operations procedures have been grouped as follows:

a. GOP - General Plant Operating Procedures - deleted for the permanently defueled plant.

b. SOP - Plant System Operating Procedures - deleted for the permanently defueled plant. These procedures have been replaced by DOPs.

c. ALP - Alarm Procedures - correcting abnormal alarm conditions - provides a description of all annunciators, their respective sensor designations, the trip setting which is associated with the alarm, along with the expected corrective action.

d. ONP - Off-Normal Procedures - deleted for the permanently defueled plant. They are now addressed by Decommissioning Operating Procedures.

e. EOP - Emergency Operating Procedures - deleted for the permanently defueled plant.

f. DOP - Decommissioning Operating Procedures - provide instructions on the operation of systems and portions of systems which require operation with the plant permanently defueled and were required to be developed as a result of the decommissioning process. Also provide instructions for placing the Plant in a stable condition under off-normal conditions.

g. Fuel Handling Procedures - specify actions for storage and shipment of irradiated fuel and associated measures to ensure nuclear and personnel safety during fuel handling.

13.5.2.3 General Operating Procedures

Previously, General Operating Procedures provided instructions for integrated plant operation including startup, shutdown and power operation. The evolutions addressed in these procedures are not feasible for the permanently defueled plant and therefore these procedures have been deleted.

13.5.2.4 System Operating Procedures

System Operating Procedures have been replaced by Decommissioning Operating Procedures.

13.5.2.5 Alarm and Response Procedures

Alarm and Response Procedures provide the required actions to be taken when an abnormality in a plant system is annunciated.

13.5.2.6 Off-Normal Procedures

Previously Off-Normal Operating Procedures were provided for operation during potential emergency conditions. They are now addressed by Decommissioning Operating Procedures.

13.5.2.7 Emergency Operating Procedures

Previously, Emergency Operating Procedures provided symptom based guidance for handling potential emergencies associated with an operating nuclear reactor. Reactor operation is not feasible for the permanently defueled plant. Therefore, these procedures have been deleted.

13.5.2.8 Decommissioning Operating Procedures

Decommissioning Operating Procedures provide instructions on the operation of systems and portions of systems which require operation with the plant permanently defueled and were required to be developed as a result of the decommissioning process. They describe plant operations including providing instruction to energize, fill, vent, drain, startup, shutdown, changing status of system operation and other instructions appropriate for the safe operation of systems and provide instructions for placing the Plant in a stable condition from off-normal conditions.

13.5.2.9 Fuel Handling Procedures

Fuel Handling Procedures specify actions for movement and shipment of irradiated fuel and associated measures to ensure nuclear and personnel safety during fuel handling.

Containment closure conditions required during fuel handling are discussed in Section 6.2.5 of this UFHSR.

To minimize the consequences of a fuel handling accident the movement of irradiated fuel is restricted to one assembly at a time into and out of the storage racks as provided in the Technical Specifications, Section 16 of this UFHSR.

To ensure controlled storage and to protect personnel from exposure to radiation, irradiated fuel is stored underwater in the spent fuel pool.

13.5.3 OPERATING PROCEDURAL SAFEGUARDS

The following procedural safeguards are established to assure the operating safety of the Big Rock Point Plant.

Instructions for operations consist of procedures required for the operation of systems and equipment associated with the plant.

The shift operating personnel are directed to follow the approved procedures unless deviation is required to prevent injury to personnel or damage to equipment or the environment.

Short term directions from Plant management to operations personnel are conveyed via Standing Orders and Daily Orders. Administrative controls have been established for these Memos and Orders.

13.5.4 MEASURES TO PREVENT OPERATING ERROR

Thorough training of the operating staff coupled with procedures minimize operational errors.

13.5.5 OTHER PROCEDURES

Procedural requirements for Security procedures are addressed in the Security Plans discussed in Section 13.6 of this Updated FHSR.

Emergency preparedness procedures are addressed in the Defueled Emergency Plan discussed in Section 13.3 of this UFHSR.

Other procedural requirements are addressed in the Consumers Energy Quality Program Description for Nuclear Power Plants, CPC-2A, discussed in Chapter 17 of this UFHSR.

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CHAPTER 15 ACCIDENT ANALYSES

15.10 DECOMMISSIONING ACCIDENT CONSIDERATIONS

15.10.1 INTRODUCTION

The following sections discuss accidents which could occur during the decommissioning period, while the reactor is permanently defueled. A wide range of potential accidents have been reviewed which could be of potential public health and safety concern if release of radioactive material were to occur as a result of the accident.

With the reactor shutdown and permanently defueled, fuel handling accidents bound all other categories of accidents with respect to the potential for offsite doses. Fuel related accidents are discussed in Section 15.10.2. External events are discussed in Section 15.10.3. Non-fuel related events which could occur as a result of decommissioning operations were assessed, compared against the Generic Environmental Impact Statement (GEIS) [Reference 15.10.1-1] and found to be within the bounds of the generic analysis. The results of these analyses are discussed in Section 15.10.4.

15.10.1.1 Dose Limits

Previous accident analyses in the Big Rock Point Updated Final Hazards Summary Report evaluated public dose to the limits established in 10 CFR Part 100 as reactor siting criteria limits at the exclusion area boundary and low population zone distances. These dose limits correspond to 25 rem total body from noble gasses and 300 rem to the thyroid from iodines, as described by TID-14844 [Reference 15.10.1-2].

Big Rock Point implemented the guidelines of the EPA Manual of Protective Action Guides (PAGs) and Protective Actions for Nuclear Accidents, EPA-400 [Reference 15.10.1-3] on January 1, 1994. EPA-400 establishes protective action levels for public protection at one rem total effective dose equivalent (TEDE) for the total body, five rem committed dose equivalent (CDE) for thyroid, and 50 rem skin dose equivalent (SDE) for skin. These doses are small fractions of the limits established in 10 CFR Part 100. Revised dose calculations reflecting plant decommissioning and dismantlement described in this section have been performed in accordance with the guidelines of EPA-400.

15.10.1.2 General Assumptions

The following assumptions have been made for the purposes of the revised accident analyses:

- No fuel is present in the reactor vessel.
- The dominant dose pathway is from airborne release with conservative dispersion factors of 1.8E-4 sec/m^3 (fumigation conditions) for elevated release and 6.48E-4 sec/m^3 for ground level release per Regulatory Guide 1.25 [Reference 15.10.1-4].
- Ground level release results in higher offsite doses, thus has been assumed in calculation of doses to the public.
- Liquid radioactivity from accidents involving radioactive liquids are assumed contained onsite.

- No containment ventilation isolation or other ventilation barrier to release of radioactivity is assumed for determination of dose to the public from the bounding fuel damage accidents.

- Plant HEPA filters will be utilized when large source terms are present (during full system chemical decontamination and when generating large quantities of radioactive particulates from dismantlement activities involving the reactor vessel, thermal shield or reactor cavity concrete). This is consistent with assumptions of the GEIS.

- Dose conversion factors of EPA-400 and its companion document, EPA-402 [Ref 15.10.1-5] have been utilized.

15.10.2 ACCIDENTS INVOLVING FUEL

All transients and accidents involving the reactor coolant system, including secondary and emergency cooling system failures, were eliminated as decommissioning accidents due to permanent removal of fuel from the reactor vessel.

Big Rock Point evaluations indicate that dose from the bounding fuel accident, assuming a free release path without ventilation isolation, falls below the Protective Action Guides (PAGs) of EPA-400 prior to 68 days post shutdown.

15.10.2.1 Previous Analyses of Fuel Handling Accidents

Previous revisions of the UFHSR retained a discussion of the fuel handling accidents that were included in the original plant FHSR. The radiological consequences arising from three of the postulated fuel handling accidents inside the reactor building were discussed:

1) drop of the fuel transfer cask onto the reactor core

2) drop of a single fuel bundle onto the reactor core

3) loss of fuel transfer cask cooling

The fuel transfer cask drop was determined to be bounding. The cask drop event assumed damage to approximately 22% of the fuel in the core based upon the cross-sectional area of the cask. The single bundle drop assumed all the rods in the bundle would fail resulting in the release of 1.2% of the core gap activity, or 5.4% of the activity resulting from the fuel transfer cask drop case.

The third event, loss of transfer cask cooling during movement of freshly irradiated fuel immediately following plant shutdown, was assumed to result in the release of radioactivity equivalent to 20% of one bundle's inventory of noble gas and iodines.

The accidents involving load drops into the reactor vessel are no longer applicable since the reactor is permanently defueled. The transfer cask cooling event is also no longer applicable since the fuel has been transferred from the reactor to the pool and a Certification of Permanent Fuel Removal has been submitted. Use of the dry fuel storage system for fuel transfer to a dry transportable canister will require its own safety evaluation prior to use.

15.10.2.2 Decommissioning Spent Fuel Pool Storage Events

This section reviews anticipated fuel handling operations with the permanently defueled reactor, to determine the accident that would produce the maximum off-site radiological consequences.

(A) Fuel Handling

A fuel handling event would be bounded by a heavy load drop event in the fuel pool, due to the larger number of fuel bundles potentially damaged (Section 15.10.2.2.3). Consequences of minor fuel handling events are limited by worker response to area monitor detection of elevated dose rates with alarms normally set at 15 to 25 mrem/hr above area background dose rates.

(B) Criticality Considerations

Spent fuel criticality considerations were addressed in Section 4.0 of the April 1979 Consolidated Environmental Impact Evaluation and Description and Safety Analysis [Reference 15.10.2-1]. Detailed nuclear analyses were performed for anticipated normal and abnormal configurations of fuel assemblies within the new fuel storage racks (center-to-center spacing of 9 inches). The analyses were based on a limiting fuel design with 3.8 weight % maximum uniformly distributed U-235 enrichment and concluded that; assuming the most reactive temperature, calculational uncertainties, and accidents, "k" infinity would be less than 0.950. Other storage racks in the pool are aluminum with a center-to-center spacing of 12 inches. The design of these racks is such that the maximum "k" effective is approximately 0.80.

Two types of fuel handling incidents were also included in the April 1979 evaluation: (1) a fuel assembly dropped during spent fuel handling that lands horizontally on top of the storage racks, and (2) a fuel assembly inadvertently positioned vertically in a water gap between the pool wall and the rack assembly. For case (1), since the rack structure and bundle design separates the fuel in the dropped assembly from other fuel in storage by a distance of more than 12 inches and the maximum rack cell "k" infinity is based on the vertically infinite dimension, the rack cell "k" infinity is not affected. The case (2) incident was determined not feasible either because a barrier is provided on the periphery of the storage locations or because the rack arrangement precludes the insertion of a bundle in the waterchannel.

(C) Heavy Load Drop Events

For decommissioning, the radiological release estimates for the following fuel accident scenarios have been conservatively evaluated:

1) All bundles in the pool (conservatively assumed to be 500 bundles) are damaged in a heavy load event. There are 441 assemblies in the fuel pool.

2) 84 bundles (100% of a core) from a reactor off-load, decayed one year, are damaged in a dry shielded configuration (out of the pool) due to an accident while loading a dry transportable canister.

Fission product fuel pin gap inventories from the final core off-load are assumed to be released from the damaged fuel in each of the above scenarios. An ORIGEN2 code run which assumed maximum fuel burnup for the final core was run and compared against the guidance of General Electric report NEDO-24782 dated August 1980 which was used in previous FHSR analyses. Results of the ORIGEN2 run confirmed that the NEDO-24782 values were appropriate for use as a conservative estimate of fission product inventory [Reference 15.10.2-4].

The following assumptions were used for the analysis:

- Fuel off-load will take 7 days from cessation of criticality. Thus, the earliest accident would conservatively involve fuel decayed a minimum of 7 days.

- No credit for containment ventilation isolation was taken.

- Full core is at maximum expected burnup (equal to highest burnup reload).

- 10% of noble gases and iodine are released to the Spent Fuel Pool (exception: 30% I-129 & Kr-85 is assumed released).

- Spent Fuel Pool water scrubs 99% of the iodine (1% release), per Regulatory Guide 1.25 [Reference 15.10.1-4]. The spent fuel pool minimum water level of 22 feet above stored fuel provides iodine scrubbing equal to or greater than that assumed in Regulatory Guide 1.25 [Reference 15.10.2.7].

- Offsite release occurs over a 2-hr interval, per Regulatory Guide 1.25 [Reference 15.10.1-4].

- X/Q is 6.48E-04 sec/m^3 for ground level releases, per Regulatory Guide 1.25 [Reference 15.10.1-4] for dose to offsite population (closest site boundary, 805 meters).

- Dose conversion factors are from EPA-400 and EPA-402 [References 5.1-3 and 5.1-5].

- Fuel damage in the dry transportable canister case does not allow credit for water scrubbing of iodine.

Offsite doses for external, skin, thyroid and TEDE were calculated for various decay times. The results are summarized in Figures 15.10.2-1 and 15.10.2-2. Figure 15.10.2-1 for damage to the assumed 500 bundles in the pool indicates that at 68 days following plant shutdown, the site boundary doses have dropped to less than the EPA Protective Action Guides of 1 rem TEDE and 5 rem to thyroid. This analysis assumed a total of 500 assemblies in the spent fuel pool with 84 being discharged from the final core off-load. The 500 assemblies was based on operating the plant until the end of license in May 2000 rather than the actual last day of operation on August 29, 1997. The pool contains only 441 assemblies per the plant license.

(D) Onsite Dose

Onsite dose effects over the range of accident scenarios described in Section 15.10.2.2.3 have been assessed on the basis of two potential variables:

- No containment isolation (maximizes airborne release), 100% release in 2 hours
- Complete isolation, no release (maximizes shine from containment)

Shine doses from an elevated plume have been calculated using the computer code "OFFSITE" which is the Big Rock Point code for evaluation of accident doses per Emergency Plan Implementing Procedure EPIP 5A-6 [Reference 15.10.2-2].

The elevated (stack) release path is appropriate for the early onsite evacuation of non-essential personnel since there is no driving force to expel radioactivity from containment (as in a loss of coolant accident, for example) with the exception of ventilation via the plant stack. Calculations have been run for Pasquill Stability G using a conservative wind speed of 1 mph. Release rates are based on releasing the complete inventory of the containment over a 2-hour interval.

Although the plant has two evacuation routes to minimize the plume exposure, it is assumed that the downwind route is used, and that 5 minutes is required to drive through the plume at the site boundary, using an elevated release X/Q of 1.8E-4 sec/m^3 for Pasquill F fumigation conditions from Regulatory Guide 1.25 (Reference 15.10.1-4). No credit was assumed for vehicle shielding or limitation of air exchange into the vehicle.

Onsite dose rates from activity contained within the reactor building have been calculated using the "MicroShield" computer code [Reference 15.10.2-3]. Internal containment structures act as thick shields to limit doses in various directions, but the conservative maximum value is presented here with only the sphere shell (0.75 inch steel) and intervening air for shielding. Doses were calculated for distances of 45 meters (from the center of containment) for the unshielded main entrance to the plant service building and 90 meters to represent the guardhouse and adjacent parking area. Dose rates at 45 and 90 meters from containment shine are presented with plume shine and site boundary inhalation dose rates in Table 15.10.2-1.

Most interior portions of the plant service building are shielded by the 4′6″ concrete wall which extends to the second level for control room shielding. Dose rates behind this shield are approximately five orders of magnitude lower than the unshielded external dose rates (less than 0.1 mrem/hr in the worst case of 7 day decay described above). Location of the Technical Support Center also takes advantage of this shield wall. Thus, doses received in transit to a shielded area, added to evacuation doses, (including those for security personnel to implement alternate security measures), are limiting for this type of accident.

For continued occupancy beyond the protection of the shield wall a total dose can be calculated from the data contained in Table 15.10.2-1. A total dose for a worker would be less than 2.5 rem. The calculation assumes the following conditions:

- The worker is stationed 90 meters from sphere centerline
- No additional shielding is provided

- A dose rate of 0.0092 Rem/hr was used (1 year, wet at 90 meters)
- A work schedule that included an initial 24 hour continuous response followed by 30 days of one eight hour shift per day (264 hours total).

The dose rate from Table 15.10.2-1 of 9.2 mrem/hr is less than the 15 mrem/hr dose rate established in NUREG-0737 for areas continuously occupied after an accident. General Design Criteria 19 of Appendix A to 10 CFR 50 requires that for control room designs adequate radiation protection must be provided to limit radiation doses to workers to 5 rem whole body for the duration of the accident. The calculated dose of less than 2.5 rem is below the General Design Criteria.

The worst case condition for continuous whole body gamma exposure requires that radioactivity be contained within the reactor building for the entire 30 day interval. In this case, no thyroid or skin doses are received. In the unlikely event that the confined radioactive material were released at the end of the 30 day interval. UFHSR Table 15.10.2-1 gives doses of 0.066 mrem to thyroid and 46.6 mrem to skin for ingress to, or egress from, the plant site during release of the entire inventory in two hours. Stack fans are the driving force for this release. Both thyroid and skin values are well below the Standard Review Plan guidelines of 30 rem for each.
Table 15.10.2-1 presents total dose for evacuation of non-essential onsite personnel. Dose rates also are presented in this table. Total doses are derived from the calculated dose rates using the following assumed exposure times:

- 1 minute at an equivalent of 45 meters from sphere traveling from anunshielded work area to a shielded assembly area
- 9 minutes at guardhouse or equivalent unshielded distance (90 meters) preparing for and performing evacuation
- 5 minutes of submersion in plume at site boundary concentrations during evacuation
- 10 minutes total exposure to plume shine (excludes time within plume)

This accident does not present any unique concerns for the decommissioning period, since doses are a small fraction of those from a Loss of Coolant Accident for which the plant was designed. Evacuation of nonessential personnel may be performed without undue exposure.

In addition to evacuation doses, calculations have been made of dose rates to which onsite essential personnel might be exposed if required to enter containment or otherwise be exposed to concentrations approaching containment concentrations. It has been determined that based on use of standard protective gear (respirators and protective garments standard for highly contaminated and high airborne areas), onsite essential personnel will remain below their occupational dose limits for any accident that results in doses less than the PAGs to offsite individuals [Reference 15.10.2-4].

15.10.2.3 Loss of Spent Fuel Pool Cooling

The Spent Fuel Pool Cooling System is a closed-loop system with a designed heat removal capability of six (6) million BTU/hr.

As part of Amendment 2 to the "Consolidated Application" for the Big Rock Point Plant Spent Fuel Pool Rack Addition [Reference 15.10.2-5], Consumers Energy Company performed analyses to demonstrate the structural integrity of the Spent Fuel Pool at elevated temperatures. Based on the analyses results, it was concluded that the pool floor, pool walls, and support walls are adequate to withstand events in which the inside pool wall surface temperature rises to and remains at 150°F.

At the time of permanent plant shutdown, an analysis was performed to determine the spent fuel pool heatup rate based on the operating history of each assembly in the pool [Reference 15.10.2-6]. This analysis determined the time required for the pool to reach 150°F from an initial pool temperature of 80°F. Concrete temperature was conservatively assumed equal to the bulk water temperature in the pool and no conductive radiative or evaporative heat loss occurs through the walls, floor, or pool surface.

To evaluate the loss of SFP cooling following shutdown and defueling of the Big Rock Point reactor, the above analysis was performed with the following assumptions:

1) Following shutdown on August 29, 1997 and defueling, 441 bundles are stored in the SFP.

2) Previous fuel reconstitution efforts resulted in the storage of individual fuel pins in the pool. To account for these pins, an additional 3 assemblies were conservatively assumed to be in the pool.

3) The initial pool temperature is 80°F.

4) The last operating cycle included 381 days critical.

Results of this analysis demonstrate that although SFP cooling capability must be maintained, the consequences of a loss of cooling event are not severe. At 93 days after permanent shutdown, the pool can experience a loss of cooling for 72 hours without exceeding the 150°F temperature limit.

On June 3, 1999, an analysis was performed (Reference 15.10.2.8) which demonstrated:

1) The SFP temperature will gain 0.30°F per hour.
2) With a starting temperature of 100°F, the pool can experience a loss of cooling for 72 hours without exceeding the 150°F temperature limit (164 hours to reach 150°F.)

Although not required, the 72 hour duration was selected to be consistent with the loss of power criteria of 10 CFR part 50, Appendix R, III.L.3. A backup supply of cooling/makeup water is available from the fire protection system in the unlikely event that both cooling and normal fuel pool makeup water are unavailable.

Cooling capability for the SFP will be retained while fuel remains in the pool. Dismantlement activities near the SFP and associated cooling system and other support systems will be controlled to prevent damage to these systems.

The time interval described here to respond to a loss of SFP cooling event is sufficient to ensure that the event is terminated, precluding any impact on the public health and safety. Implementation of the restrictions presented above will reduce the probability of occurrence during decommissioning activities when assemblies are still located in the pool.

15.10.2.4 Loss of Spent Fuel Pool Water Level

The Spent Fuel Pool is a concrete structure which was lined with a 3/16 inch stainless steel plate in 1974. During this modification, the original drain line was removed and an eight-zone leakage detection system consisting of stainless steel channels between the liner and concrete was installed. There are no direct connections to the pool capable of draining the water. The pool utilizes anti-siphon makeup lines and a weir discharge system to maintain approximately 22 feet of water over the active portion of the fuel and preclude water loss if damage were to occur to any pool-connected piping systems [Reference 15.10.2-7]. Level indication and leak detection capabilities will be retained as long as fuel resides in the pool.

The loss of cooling evaluation of Section 15.10.2.3 bounds any event which could result in a loss of pool water due to boiling. Response to provide makeup for water loss can be accomplished prior to the time at which decreased water level and lowered shielding become a concern.

15.10.3 EXTERNAL EVENTS

An assessment of external events was made to evaluate the effects of natural and manmade events on decommissioning activities. The hazards associated with these events are assumed to be consistent with those that could have occurred while Big Rock Point was in operation. This section describes the evaluations performed to assure protection of public health and safety.

15.10.3.1 Loss of Off-Site Power

During decommissioning offsite power is supplied from the 46 kv transmission system. Loss of the 46 kv transmission line would not result in a sustained loss of SFP cooling. The Defueled Technical Specifications require that the capability to supply makeup to the pool be maintained by: a diesel generator capable of providing power within twenty four hours to operate an on-site electric motor driven pump or one off-site source of ac power capable of providing power to operate an on-site electric motor driven pump, or an onsite pump not requiring electrical power shall be capable of providing makeup water to the SFP flow within twenty four hours.

For those time periods evaluated as part of the Big Rock Point Probabilistic Risk Analysis [Reference 15.10.3-1] the longest recovery period for a loss of power from a single offsite power source was 33 hours. The defueled Tech Specs were submitted on September 20, 1997 with an effective date after November 30, 1997. This effective date is beyond the 93 day cooling time shown in Section 15.10.2.3 that allows a loss of cooling for 72 hours without exceeding 150°F pool water temperature. There is adequate time available, during this 72 hour period, to take corrective actions precluding a challenge to fuel integrity during a loss of cooling event. Such actions could include restoring the offsite power source, powering the cooling system from an alternate power supply or obtaining additional water for cooling.

15.10.3.2 Aircraft Hazards

Consumers Energy Company evaluated potential aircraft hazards on Big Rock Point in response to Systematic Evaluation Program Topic II-1.C [Reference 15.10.3-2] and as part of the Big Rock Point Spent Fuel Pool Expansion Hearings. The evaluations and NRC Staff's conclusions determined the cumulative realistic probability of an aircraft crashing into the plant was very low (2E-08 per year) in 1984 and has since been further reduced by the closing of military training routes. Further consideration of the interaction between aircraft hazards and decommissioning is not warranted.

15.10.3.3 External Flooding

Consumers Energy Company evaluated flooding potential and protection requirements at Big Rock Point in response to Systematic Evaluation Program Topics II-3.B and II-3.B.1 [Reference 15.10.3-2]. As a result of these reviews it was determined that safe shutdown can be accomplished for flooding events in which the flooding elevation does not exceed about 594.0 ft mean sea level (MSL) at the turbine building and about 589.0 ft MSL outside and about 584.0 ft MSL inside the intake structure. At these elevations, the interior of the structures would be flooded, but the pumps and electric power supplies necessary for shutdown would be above the flooding elevation. NRC staff review of detailed hydrologic engineering calculations, maps, level surveys, and photographs concluded that external flooding caused by either Probable Maximum Precipitation (PMP) or lake flooding would not exceed 594.0 ft mean sea level (MSL) at the turbine building or 584.1 ft MSL inside the intake structure. In view of this finding and that the extreme nature of the assumptions regarding a probable maximum flood event (PMF), the staff concluded that the plant can safely shut down.

During decommissioning plant shutdown is not of concern. Service water pump(s) which support SFP cooling and fire pump(s) are located in the intake structure and would continue to provide their required functions during a PMF.

15.10.3.4 Probable Minimum Water Level

Systematic Evaluation Program Topic II-3.C [Reference 15.10.3-2] evaluation identified a probable minimum lake water level (570.0 ft MSL) that could potentially cause loss of the required net positive suction head for the service water and fire pumps. Consumers Energy Company's evaluation concluded that the minimum water elevation resulting from a negative lake surge or seiche would be 572.1 ft MSL with all pumps operating. This analysis is applicable during decommissioning and assures the availability of SFP cooling during these type events.

15.10.3.5 Tornados and Extreme Winds

The annual strike probability of a tornado is very low for the Big Rock Point site. As discussed in Section 2.3.1 of the Big Rock Point FHSR (SEP Topic II-2.A) [Reference 15.10.3-2], tornados have been reported 25 times between 1950-1977 within a 60 mile radius of the Big Rock Point site, excluding the water area over Lake Michigan. Based upon the tornado characteristics for the site region, probability calculations indicate that the recurrence interval for a tornado at the site is about 5150 years.

Analyses concluded the containment vessel has a limiting wind velocity above 250 mph and the screenhouse/discharge structure which houses the service water pumps has a limiting wind velocity of 152 mph. The SEP review concluded that the balance of plant structures could be expected to withstand a 100-year reoccurrence wind of 80 mph. Extreme winds or a tornado would likely be preceded by a sufficient warning period to take appropriate actions. Should a loss of SFP cooling occur, the 72 hour time to reach 150°F provides adequate time to restore pool cooling. Thus, further consideration of these events is not warranted.

15.10.3.6 Earthquake

As discussed in Section 2.5.1 of the Big Rock Point Updated FHSR, the 1961 seismicity evaluations concluded the probability that earthquakes of significant intensity will occur in the general site area appears to be very low. Coast and Geodetic Survey information identified seven earthquakes in Michigan prior to October 1959, all of which were classified as intermediate or minor. The nearest recorded earthquake was in 1905 and was centered near Menominee, Michigan, approximately 110 miles from the plant site.

Due to the age of Big Rock Point, the majority of systems, structures, and components were originally designed to 0.05g, which was twice the Uniform Building Code (UBC) seismic criterion of 0.025g. However, an extensive seismic re-evaluation program was conducted as part of SEP Topic III-6 which assessed seismic safety margins up to .12g [Reference 15.10.3-2]. The seismic capability of SFP storage racks, SFP makeup line, and the reactor crane were addressed and found acceptable as part of the SFP Expansion [References 15.10.2-4 and 15.10.3-3].

During decommissioning, the SFP and plant systems that support SFP cooling provide the same safety functions as they did during plant operation. Based upon the above and that loss of SFP cooling has been evaluated, further seismic evaluation for plant decommissioning is not warranted.

15.10.3.7 Fire Events

A fire event could affect plant systems and equipment used during decommissioning. Adequate levels of fire protection features as described in the Fire Protection Program will be maintained to minimize the probability of occurrence of a fire and should a fire occur, limit the consequences. These features include:

- Fire suppression systems
- Control of transient combustible materials and ignition sources
- Personnel training and qualification programs

Of primary concern will be areas where a fire could impact SFP cooling and support systems. As a minimum, fire suppression capability will be retained to allow prompt mitigation. However, should a fire cause a loss of SFP cooling, adequate time is available to restore the cooling system to service. In the event that major equipment damage would occur prior to a significant reduction in decay heat load, adequate cooling can be accomplished by establishing makeup cooling flow to the pool as discussed in Section 15.10.2.3. Therefore, the health and safety of the public are not adversely affected by a fire event.

15.10.3.8 Freezing

Absence of reactor heat load and decreasing decay heat generation while the fuel is stored in the spent fuel pool results in increased reliance upon the plant heating system to maintain reactor building and other important structures above freezing under harsh winter conditions. Initiators of potential freezing conditions would include loss of offsite power, boiler problems or ventilation system failures.

The capability to heat and ventilate the reactor building will be retained while fuel remains in the spent fuel pool.

The fuel pool itself, with its large volume and decay heat from the 441 fuel bundles, is not expected to freeze. The anti-siphon makeup line and design of the fuel pool discharge weir preclude loss of fuel pool water by damage to any support piping by freezing. A relatively small volume of fuel pool water from the cooling system external to the pool itself could be lost due to a freeze rupture of the SFP cooling system. With the surge tank and syphon breakers, pool water level would be maintained at near the operating level. Cooling water leakage would accumulate in containment sumps and be pumped for processing by the radwaste system. Due to location of the fuel pool within the reactor building, there is no direct path for this water to escape to the environment.

15.10.4 NON-FUEL RELATED DECOMMISSIONING ACCIDENTS

An evaluation of potential non-fuel related decommissioning accidents at Big Rock Point has been performed. Decommissioning activities following final plant shutdown were evaluated, including system and equipment deactivation, decontamination, and dismantlement; radioactive material handling and storage; and transportation of radioactive materials. Types of postulated accidents reviewed were: explosions and fires, loss of contamination control, waste transportation accidents, external events, and natural phenomena. In addition to the standard decommissioning activities, postulated accidents associated with potential long term storage of radioactive waste during decommissioning also were evaluated.

Based on this review, it is concluded that all postulated decommissioning accidents for Big Rock Point are bounded by the results described in the GEIS [Reference 15.10.1-1]. Thus, as concluded by the GEIS, decommissioning will have a minimal impact on public safety and health. This conclusion is further supported by the fact that Big Rock Point, at a rating of 240 Mwt, is a significantly smaller plant than the 3320 Mwt reference BWR. This fact reduces total quantities of radioactivity present on site, total volumes of waste produced and shipping volumes.

15.10.4.1 Accident Prevention and Mitigation

The baseline BWR assumed in the GEIS utilizes high efficiency particulate (HEPA) filters for plant ventilation effluents, whereas the Big Rock Point ventilation system did not include HEPA filters. HEPA filters were only used for specific sources such as fume hoods and offgas. To remain within the bounds of the GEIS and recognizing that during dismantlement airborne particulate releases could be significantly reduced by plant HEPA filtration, a HEPA filtration system was installed in the ventilation system and will be used for dismantlement activities involving major source terms of particulate activity.

Figure 15.10.2-1

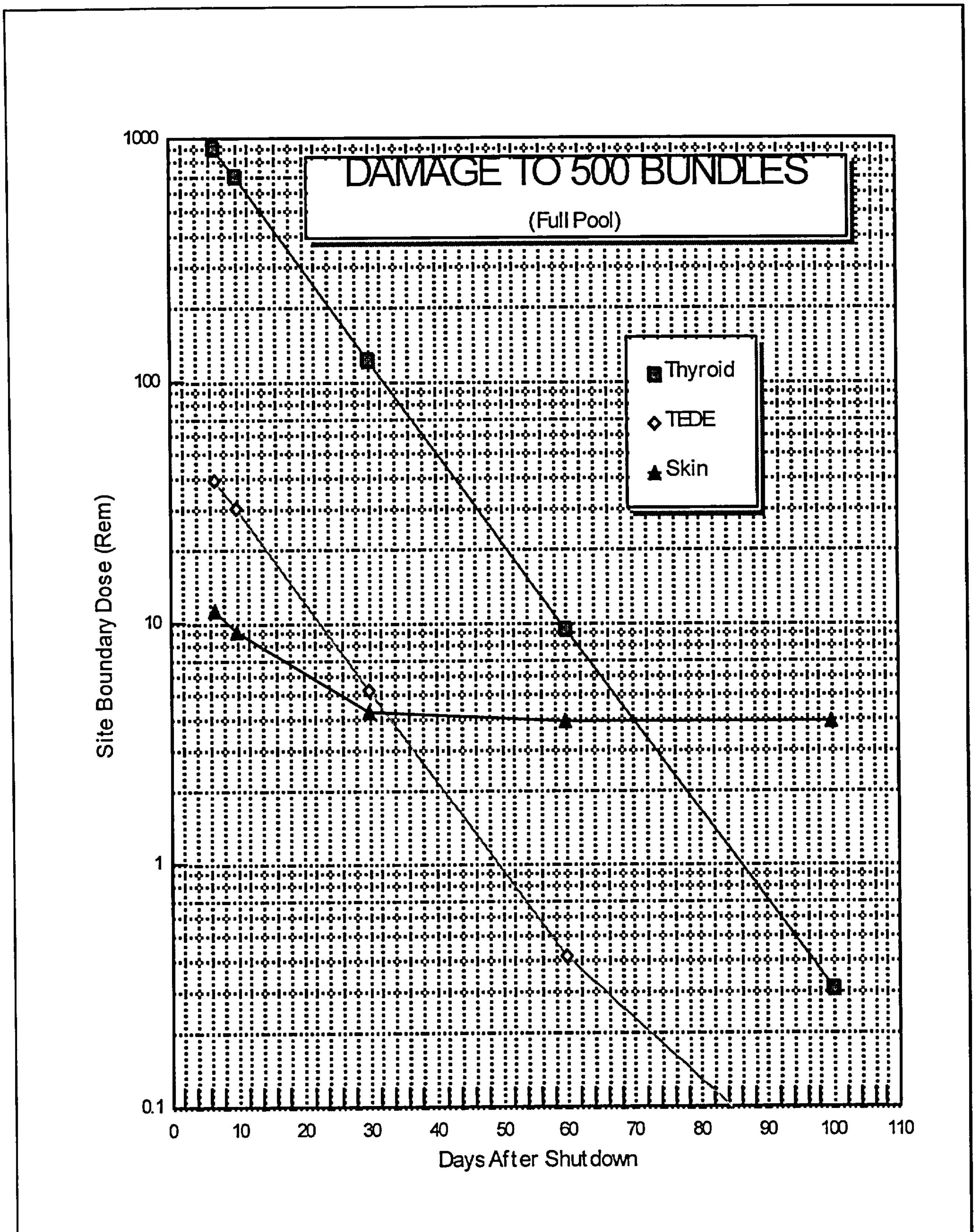

Figure 15.10.2-2

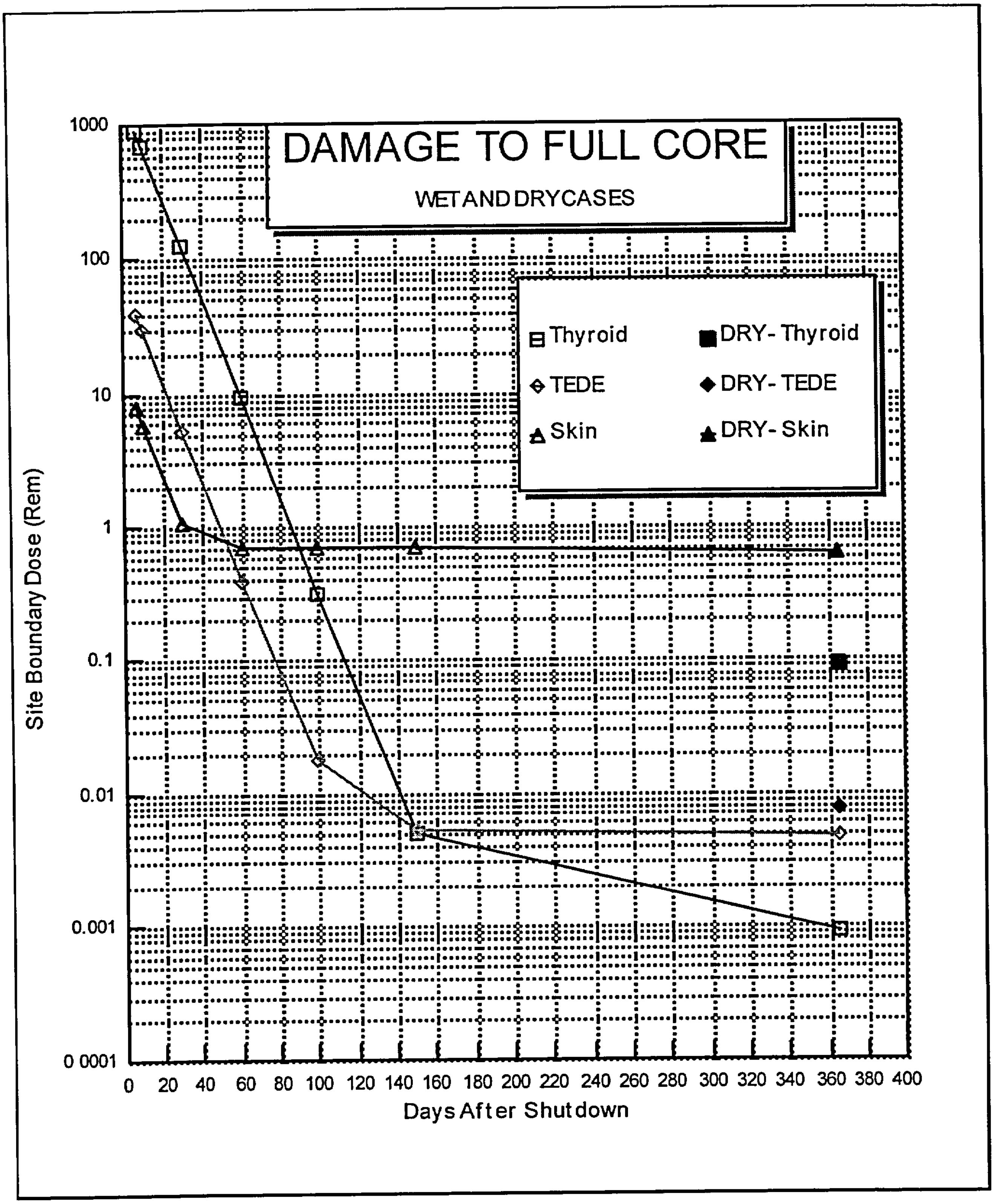

TABLE 15.10.2-1
WORST CASE (500 BUNDLE)[5] ONSITE DOSE RATES AND ACCUMULATED DOSES FOR EVACUATION OF ONSITE PERSONNEL

Exposure type	Time (min)	7 Days Wet		150 Days Wet		365 Days Wet		365 Days Dry[5]	
Containment Shine 45m (DDE)[1]	1	0.41	6.83	0.0471	0.785	0.0465	0.775	0.0078	0.130
Containment Shine 90m (DDE)[1]	9	0.077	11.6	0.0093	1.39	0.0092	1.38	0.0015	0.231
Plume Shine (DDE)[1]	10	1.27	212	0.0012	0.20	0.0012	0.20	0.0002	0.033
Plume Thyroid (CDE)[2]	5	134	11,166	0.0014	0.117	0.0008	0.066	0.0134	1.12
Plume Skin (SDE)[3]	5	7.1	588	0.559	46.6	0.559	46.6	0.094	7.84
Plume (TEDE)[4]	5	13.2	1,100	0.0043	0.355	0.0004	0.034	0.0007	0.058
Containment + Plume (TEDE)[4]	15[6]	--	1,330	--	2.73	--	2.39	--	0.452

[1] DDE = Deep Dose Equivalent
[2] CDE = Committed Dose Equivalent
[3] SDE = Skin Dose Equivalent
[4] TEDE = Total Effective Dose Equivalent
[5] Dry Event for 1 yr decayed core (84 Bundles)
[6] 10 minutes exposure to plume shine plus 5 minutes submersion in plume

15.10.5 REFERENCES:

15.10.1-1 NUREG-0586, Generic Environmental Impact Statement on Decommissioning Nuclear Facilities, 1988.

15.10.1-2 J.J. Dinunno, et al, Technical Information Document #TID-14844, Calculation of Distance Factors for Power and Test Reactor Sites, U.S. Atomic Energy Commission, March 1962.

15.10.1-3 EPA 400-R-92-001, Manual of Protective Actions Guides and Protective Actions for Nuclear Incidents, May 1992.

15.10.1-4 Regulatory Guide 1.25 (Safety Guide 25), Assumptions Used for Evaluating the Potential Radiological Consequences of a Fuel Handling Accident, U.S. NRC, 1972.

15.10.1-5 EPA 402-R-93-081, External Exposure to Radionuclides in Air, Water and Soil, September, 1993.

15.10.2-1 Consumers Power Company, Big Rock Point Spent Fuel Rack Addition Consolidated Environmental Impact Evaluation and Description and Safety Evaluation, April 1979.

15.10.2-2 Big Rock Point Emergency Implementing Procedure EPIP 5A-6, Automated Dose Assessment Program, Revision 149 (1994).

15.10.2-3 Grove Engineering, Inc., MicroShield Version 4, December 30, 1993.

15.10.2-4 Big Rock Point Engineering Analysis, Fuel Damage Decommissioning Accident Analysis for BRP, EA-BRP-DP-CH5-1, December, 1994.

15.10.2-5 Consumers Power Company, Big Rock Point Spent Fuel Rack Addition Consolidated Environmental Impact Evaluation and Description and Safety Evaluation, Amendment 2, January 1983 and Amendment 3, July 12, 1983.

15.10.2-6 Big Rock Point Administrative Procedure 2.2.21, Fuel Pool Decay Heat Program, Revision 2.

15.10.2-7 Big Rock Point Condition Report C-BRP-97-0424, Assumptions Made in Engineering Analysis Supporting D-Plan, Lack A Detailed Basis, dated August 1, 1997.

15.10.2-8 Big Rock Point Engineering Analysis, Spent Fuel Pool Heatup Spreadsheet Results, EA-DOP-04-01, June 3, 1999.

15.10.3-1 Consumers Power Company, Big Rock Point Probabilistic Risk Assessment, Response to Generic Letter 88-20, dated May 5, 1994.

15.10.3-2 NUREG-0828, Integrated Plant Safety Assessment - Systematic Evaluation Program for the Big Rock Point Plant, Final Report, May 1984.

15.10.3-3 Supplemental Safety Evaluation by the Office of Nuclear Reactor Regulation Relating to the Modification of the Big Rock Point Spent Fuel Storage Pool, U.S. Nuclear Regulatory Commission, November 17, 1983.

15.10.4-1 Consumers Power Company, Updated Final Hazards Summary Report (FHSR), Big Rock Point Plant, Revision 4, May 31, 1994.

15.10.4-2 NUREG/CR-0672, Technology, Safety and Costs of Decommissioning a Reference Boiling Water Reactor Power Station, Volumes 1 and 2, and Addendum 1.

15.10.4-3 Big Rock Point 10 CFR 50.59 Safety Evaluation, Radioactive Waste Storage, dated May 25, 1993.

ATTACHMENT IV

CONSUMERS ENERGY COMPANY
BIG ROCK POINT PLANT
DCKET 50-155 AND 72-043 – LICENSE DPR-5

REVISION 10 TO THE UPDATED FINAL HAZARDS SUMMARY REPORT
(UFHSR)
Submitted September 17, 2002

Detailed Listing of UFHSR Revision 10 Changes
Addressed Section by Section

27 Pages

Detailed Listing of Revision 10 Changes
Addressed Section by Section
Attachment IV

Chapter 2 SITE CHARACTERISTICS

Evaluated on Quality Review Form Log # 384-01.

BACKGROUND INFORMATION

Environmental Report for Decommissioning
The Environmental Report for Decommissioning was submitted to the NRC on February 27, 1995. This revision incorporated the Environmental Report for Decommissioning (New BRP Volume 32) in the UFHSR (Chapter 2). It also removed redundant Volume 32 information from Chapter 2.

The Volume 32 (and subsequent UFHSR Chapter 2) revisions provided consistency with the PSDAR. It reflects PSDAR activities with respect to decommissioning, dismantlement, and schedule. It better defines site location and incorporated information from the UFHSR, Chapter 2. Geological information was updated with new information. Occupational exposure doses received through 2000 were added. Dose estimates following site release was revised and consistent with PSDAR. RESRAD information is in the process of revision – obsolete information was deleted. Spent fuel management plan was revised to reflect current knowledge (e.g., deletion of postulated shutdown date) and is consistent with the PSDAR. The Environmental Report was updated to reflect 2000 census data and other new or updated information.

CHAPTER 2 REVISIONS
Entire Sections were issued in Revision 10 Chapter 2 of the UFHSR for clarity. This is to avoid blank pages, to avoid problems with page renumbering, and to ease text formatting.

Table of Contents, although not revised in Revision 10, was updated (Revision 10 in the upper right hand corner of each page) to eliminate user confusion on current revision of the Chapter.

2.1 GEOGRAPHY AND DEMOGRAPHY

2.1.1 SITE LOCATION AND DESCRIPTION,
Added a paragraph referencing BRP Volume 32, Environmental Report for Decommissioning.

2.1.1.1 Immediate Environs
Deleted section; redundant to information in Volume 32

2.1.1.2 Site Access
Deleted section; redundant to information in Volume 32

2.1.1.3 Plant Features

Renumbered former section 2.1.1.3 to 2.1.1.1, Plant Features. Third paragraph deleted components (e.g., recirculation piping, pumps, turbine generator, etc) that have been removed in the decommissioning process.

2.1.1.4 Surrounding Area

Renumbered 2.1.1.4 to 2.1.1.2, Surrounding Area

Table 2.1 STATISTICS OF SURROUNDING AREA

Updated population information to reflect 2000 census information.

2.1.3 POPULATION DISTRIBUTION

Added a paragraph referencing BRP Volume 32, Environmental Report for Decommissioning.

Population Within Five (5) Miles and Table 2.2.

Deleted former Section 2.1.3.1, Population Within Five (5) Miles and Table 2.2. This section is redundant to information in Volume 32.

2.1.3.1 Population Within Thirty (30) Miles

Renumbered Section 2.1.3.2 to 2.1.3.1. Updated section to include information from 2000 census.

2.1.3.2 Seasonal Population

Renumbered Section 2.1.3.3 to 2.1.3.2, Seasonal Population

2.1.3.3 Low Population Zone and Emergency Planning Zones

Renumbered Section 2.1.3.4 to 2.1.3.3.

2.1.3.4 Population Centers

Renumbered Section 2.1.3.5 to 2.1.3.4.

Updated Table 2.3 to include 2000 census information. Minor editorial revision in last paragraph, changed "presently nor foreseeable" to "currently nor foreseeably"

2.1.3.5 Population Density

Renumbered Section 2.1.3.6 to 2.1.3.5. Revised paragraph in this section to reflect 2000 census data. Minor editorial revisions, former upper case wording in the first and last sentences were corrected. "Plant lifetime" to "duration of the Plant's NRC license" was revised in the last sentence.

2.1.3.6 Evaluation Summary
Renumbered Section 2.1.3.7 to 2.1.3.6.

Figure 2.3, Plant Facility Identification was updated to reflect current building configuration at the site.

Figure 2.4, 1990 Permanent Population Within the Big Rock Point Plume Exposure EPZ, was deleted. This figure is part of the BRP Volume 32, Environmental Report for Decommissioning.

2.2 NEARBY INDUSTRIL, TRANSPORTATION, AND MILITARY FACILITIES

2.2 1 LOCATIONS AND ROUTES

First paragraph, reference to Figure 2.5 (listing of manufacturing plants) was deleted and replace with a reference to BRP Volume 32, Environmental Report for Decommissioning.

Second paragraph, Deleted paragraph with reference to table 2 6 (additional listing of City of Charlevoix facilities) redundant to information in Volume 32.

Last paragraph, corrected typographical "route" to "routes."

Deleted Figures 2.5 and 2.6 at end of section.

2.3 METEOROLOGY

2.3.1.1 Temperature (NRC-SE)

Deleted first paragraph and added reference to BRP Volume 32, Environmental Report for Decommissioning.

Second paragraph, corrected typographical "equalled" to "equaled."

2.3.1.2 Thunderstorms and Lightening Strikes (NC-SE)
Deleted first paragraph and added reference to BRP Volume 32, Environmental Report for Decommissioning

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2.3.1.4 Snowfall and Snow Load (NRC-SE)
Deleted first paragraph and added reference to BRP Volume 32, Environmental Report for Decommissioning.

Last paragraph, revised typographical error, 225 lb/ft^2 to 115 lb/ft^2 consistent with SRC-SER on SEP Topic II-2.A, Severe Weather Phenomena and third paragraph of this section.

2.3.1.5 Design Wind Speed (NRC-SE).
Added new first paragraph to reference BRP Volume 32, Environmental Report for Decommissioning.

2.3.1.6 Tornados (NRC-SE)
Added new first paragraph to reference BRP Volume 32, Environmental Report for Decommissioning.

2.5 GEOLOGY, SEISMOLOGY, AND GEOTECHNICAL ENGINEERING

2.5.1 BASIC GEOLOGY AND SEISMIC INFORMATION
Sixth paragraph, deleted earthquake history and added reference to BRP Volume 32, Environmental Report for Decommissioning.

2.5.1.1 Regional Geology
Added reference to BRP Volume 32, Environmental Report for Decommissioning. Deleted remainder of section.

2.5.1.2 Site Geology
Added reference to BRP Volume 32, Environmental Report for Decommissioning. Deleted former first and second paragraphs. Deleted all but last sentence in former paragraph 3. Corrected typographical error in that sentence "normal lake" to "normal level."

Chapter 2 References
Added two new References:

31. U.S. Department of Commerce Bureau of Census, 2000 census data, http://www.census.gov , and
32. BRP Volume 32, Environmental Report for Decommissioning.

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Chapter 3 DESIGN OF STRUCTURES, COMPONENTS, EQUIPMENT, AND SYSTEMS

Evaluated on Quality Review Form Log # 757-99, 51-00, 139-00, 278-00, 281-00, 104-01, 119-01, 154-01, 425-01, 553-01, 775-01 and 286-02.

BACKGROUND INFORMATION

Facility Change (FC) FC-702 removed the 12' diameter equipment lock in its entirety and replaced it with a Containment Construction Access Opening (CCA).

Minor Alteration (MA) MA-99-0018, installed a support structure used to facilitate the movement of dry fuel storage casks through the sphere out to the transport trailer.

125-ton design rated load (105-ton Maximum Critical Load) containment building crane was installed in Facility Change (FC) FC-706.

Editorial Revisions were made to correct spelling and grammatical errors, and to improve clarity in the section.

CHAPTER 3 REVISIONS

Entire Sections were issued in Revision 10 Chapter 3 of the UFHSR for clarity. This is to avoid blank pages, to avoid problems with page renumbering, and to ease text formatting.

Table of Contents, although not revised in Revision 10, was updated (Revision 10 in the upper right hand corner of each page) to eliminate user confusion on current revision of the Chapter.

Table 3-1 CLASSIFICATION OF STRUCTURES, SYSTEMS, AND COMPENENTS BIG ROCK POINT NUCLEAR POWER PLANT

Added a new row for containment building crane 125-ton (DRL)/ 105-ton (MCL), deleted old information on containment building crane.

Notes

Added Note 10, for Containment Building Crane installed in FC-706.

3.8.1.2 Penetrations and Access Openings Section on Access Openings

Added new first paragraph to describe the containment construction access (CCA) opening that replaced the equipment lock.

Revised former first (now second) paragraph to delete reference to the equipment lock.

Deleted former second paragraph that discussed equipment lock floor.

Added new paragraph (now fourth) to describe minor alteration to install support structure for dry fuel storage though the CCA.

3.8.1.3 Isolation Valves

Deleted last sentence of first paragraph, editorial comment.

Fifth paragraph, second from last sentence, revised wording Eliminated reference to closing supply ventilation fans – containment closure procedure.

Deleted former sixth paragraph describing containment vacuum relief.

3.8.1.6 Containment Construction and Testing

After the fourth bullet (discussing steel column loads) added a note. FC – 702 removed some weight and columns were pre-loaded.

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Chapter 6 ENGINEEERED SAFETY FEATURES (ESF)

Evaluated on Quality Review Form Log # 51-00, 278-00, 154-01, and 287-02.

BACKGROUND INFORMATION
Revisions clarified the descriptions of ventilation system and equipment.

Reference Defueled Technical Specifications (DTS) verses Technical Specifications.

Reference DTS definition of Containment Closure rather than requiring containment closure during fuel handling (for consistency.)

Deleted reference to Main Steam Isolation Valve seal leakage control system (permanently removed plant equipment.)

Facility Change (FC) FC-702 resulted in revision of containment conditions (no vacuum relief.)

CHAPTER 6 REVISIONS
Chapter 6, Sections 6.2, CONTAINMENT SYSTEMS, and 6.7, MAIN STEAM ISOLATION VALVE SEAL LEAKAGE CONTROL SYSTEM , were issued in their entirety in Revision 10 of the UFHSR for clarity, to avoid problems with page renumbering, and to ease text formatting.

Table of Content, was revised in Revision 10, and was updated (Revision 10 in the upper right hand corner of each page).

6.2.1 CONTAINEMNT FUNCTIONAL DESIGN DESCRIPTION
Third paragraph, deleted reference to containment vacuum relief.

6.2.2.1 CIS General Description
Added reference to Defueled Technical Specifications (rather than Technical Specifications.) Eliminated reference to UFHSR Chapter 16.

Last sentence, eliminated reference to containment vacuum relief and section 6.2.4.1.9.

6.2.4 CIS VENTILATION VALVES ISOLATION AND VACUUM RELIEF
Title CIS VENTILATION VALVES ISOLATION AND VACUUM RELIEF was revised to CIS VENTILATION VALVES ISOLATION. Revised the paragraph in this section to reference Section 6.2.4.1.8.

6.2.4.1.4 Containment Ventilation Valve Operability Requirements
Revised paragraph, deleted vacuum relief operation, changed tense from "are" to "is", and added "Defueled" before Technical Specification and eliminated reference to Chapter 16 (former location of TS).

6.2.4.1.9 Containment Vacuum Relief
Entire section was deleted. New paragraph was added to reference FC – 702 and the obsolesce of the containment vacuum relief.

6.2.5 CONTAINMENT SPHERE INTEGRITY REQUIREMENTS
Last sentence of the paragraph, was re-written to reference Defueled Technical Specifications and containment closure requirements.

Deleted sub-section title 6.2.9.1, Manual Overrides Annunciation. All information following is historical.

Deleted Section 6.2.9.2, Automatic Overrides Annunciation. This Section formerly discussed vacuum relief.

6.2.9 SAFETY CIRCUIT OVERRIDES ANNUNCIATION
Corrected spacing in section.

6.2.11 COMBUSTABLE GAS CONTROL IN CONTAINMENT
Revised the wood "cooling" to "coolant".

6.2.12 CONTAINMENT VENYTILATION
Deleted last sentence, air flow though containment configuration description.

6.4.2 CONTROL ROOM HABITABILITY
Editorial revision, add reference to plant monitoring station (new first sentence) and replace "control room" with "plant monitoring station" in the last sentence.

6.7 MAIN STEAM ISOLATION VALVE SEAL LEAKAGE CONTROL SYSTEM
Section was revised to reflect that these are historical components, no longer required for the permanently defueled plant.

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Chapter 9 AUXILIARY SYSTEMS

Evaluated on Quality Review Form Log # 51-00, 142-00, 276-00, 408-00, 451-00, 69-01, 104-01, 119-01, 127-01, 128-01, 321-01, 553-01, 718-01, 758-01, and 288-02.

BACKGROUND INFORMATION

The revisions in this chapter were most extensive of all chapters revised, primarily due to the installation of the Containment Building Crane and associated activities including a Defueled Technical Specification (DTS) Revision and Nuclear Regulatory Safety Evaluation Report (SER) (September 28, 2001, Big Rock Point Plant – Issuance of Amendment RE: Fuel Handling and Control of Heavy Loads and to Include the Removal of the Fuel Transfer Cask.)

Listed below are descriptions of changes, in chronological order of origin:

QR Log # 51-00	FC-702 removed the equipment lock crane
QR Log # 142-00	MA-00-008, Removal of F-14 Heating/Cooling Unit to Facilitate Rx Vessel Removal
QR Log # 276-00,	MA-00-0018, Reactor Cavity Ventilation Modification
QR Log # 408-00	MA-00-0026, Redesign water to fire hose station 15 and reroute SFP makeup line
QR Log # 451-00	UFHSR revision to clarify ventilation systems/equipment utilized during decommissioning
QR Log # 69-01	MA-00-0034, Replace Demineralized Water Pump
QR Log # 104-01	FC –0706, Installation of the Containment Building Crane
QR Log # 119-01	Defueled Technical Specification Change (Associated with FC-706)
QR Log # 127-01	MA-01-0007 / WO12110131, Service Building 2nd and 3rd Floor Electrical Isolations, deleted reference to control room lighting (ELUs)
QR Log # 128-01	MA-01-0008 / WO12110132, Service Building 2nd and 3rd Floor Mechanical Isolations
QR Log # 321-01	DOP-9 justified eliminated vacuum relief since the Containment is no longer a pressure vessel.
QR Log # 553-01	FC-0706, Installation of the Containment Building Crane
QR Log # 718-01	MA-01-0031, Removal of the Service Water Monitor
QR Log # 758-01	SER 9/28/01, DTS change due to installation of the Containment Building Crane, Control of Heavy Loads
QR Log #288-02	(Revisions due to Overall Technical Review of the Chapter) Editorial Changes, Added fire system piping to list of piping systems connected to the Spent Fuel Pool (MA-00-0026), Deleted references to control rod blades and racks in the spent fuel

pool,
Added a reference to clarify historical information,
Deleted reference to obsolete reactor tools,
Added a reference to an analysis on dose rates used to determine depth of water for dry fuel storage transfer cask loading to keep dose rates ALARA,
Remove condenser water box reference (Non-quality-related component was removed in DWP-TCB02D),
Revised paragraph on the flow path of water for batching, associated with MA-99-0049 and DWP-TCB04C (section was not revised in revision 9 to the UFHSR),
Corrected Main Diesel Generator configuration (well water functions to prime the cooling water pump, not to cool the MDG), and
Revised the reference from Technical Specifications (now Defueled Technical Specifications or DTS) to the Off-Site Dose Calculation Manual (ODCM), since the ODCM is incorporated by reference in the DTS.

CHAPTER 9 REVISIONS

Table of Contents, Section 9.1, FUEL STORAGE AND HANDLING, Section 9.2, WATER SYSTEMS, Section 9.3, PROCESS AUXILIARIES, Section 9.4, HEATING AND VENTILATION SYSTEMS (VAS), Section 9.5, OTHER AUXILIARY SYSTEMS, and Chapter 9 References were issued in their entirety in Revision 10 of the UFHSR for clarity, to avoid problems with page renumbering, and to ease text formatting.

Table of Contents

Revision 10 was added in the upper right hand corner of each page.
9.2.2 Section title was revised to match the title within the Chapter.

9.1 FUEL STORAGE AND HANDLING

9.1.2 SPENT FUEL POOL SYSTEM (SFP)

Paragraph four, deleted reference to fuel transfer cask and added "approved."

Paragraph 6, deleted reference to the fuel transfer cask and added dry fuel storage and single-failure-proof crane.

Former paragraph 7 – deleted entire discussion on 60-ton fuel shipping cask.

9.1.2.1 Spent Fuel Pool Design

Table 9-1, SPENT FUEL POOL STORAGE RACKS, Added a note on administrative control for moving casks over spent fuel. Revised notes in table.

Tenth paragraph, editorial revision deleted a comma after "enrichment" and deleted the word "below" from parenthetical reference.

9.1.2.1.3 Spent Fuel Handling Accident Analysis

Last paragraph was rewritten to address current administrative controls with the single-failure-proof crane.

9.1.2.1.4 Spent Fuel Pool Piping Systems and Failure Analysis

Corrected spacing.

Added to the list of piping that connects to the spent fuel pool (makeup lines): "d. Fire System piping (Provides emergency makeup and discharges above the pool with no direct connection to water in the spent fuel pool.)" The fire system piping was originally classified as part of the Post-Incident System (PIS). It is the emergency makeup line to the SFP (28 gpm). The addition of a description of this line is consistent with the Spent Fuel Pool Makeup Water description in Chapter 9.1.3.4 of the UFHSR.

9.1.2.1.5 Spent Fuel Pool Surge Tank

Editorial revision added "g" after "0.05" in the last sentence of the paragraph in this section.

9.1.3 SPENT FUEL POOL COOLING, CLEANUP, AND MAKEUP SYSTEMS

First paragraph, editorial revision, added "the" in front of "April" in the first sentence.

9.1.3.2 Spent Fuel Pool Cooling.

First paragraph, corrected the installation date of the spent fuel pool cooling skid from "January of 1998" to "1999."

Fourth paragraph, revised "fuel pumps" to "spent fuel pool cooling system pumps" for clarity.

Fifth paragraph, revised "fuel pool heat exchangers" to "spent fuel pool cooling system heat exchangers" for clarity.

Sixth paragraph, revised "heat exchangers also have" to "spent fuel pool cooling system heat exchangers have" for clarity.

9.1.3.4 Spent Fuel Pool Makeup Water

Third paragraph, added a new second sentence to reference minor alteration (MA) that modified the spent fuel pool makeup line.

Fourth paragraph, revised the paragraph to reflect the makeup line configuration after the minor alteration.

Seventh paragraph, editorial, deleted period after "1984."

9.1.3.4.1 Fourth paragraph – delete reference to control blades and associated racks in the spent fuel pool. Control blades and associated racks were removed and shipped off-site as part of the spent fuel pool cleanup project. They are no longer contained in the spent fuel pool.

Last paragraph, SFP fuel load in this paragraph does not match 125-day load in Table 9-2. Added "(Reference 5)" at end to clarify that this is historical information. The last paragraph of 9.1.3.4.1 is a historical reference and its source is Reference 5 at the end of this chapter. The addition of "(Reference 5)" at the end of this paragraph was done to clarify its source and that the information is previous to that in Table 9-2.

9.1.3.4.2 First paragraph, first sentence, changed the verb "is" to "was."

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9.1.4 FUEL HANDLING SYSTEM (FHS)

9.1.4.1 General Description and Servicing Equipment
Revised the first and second paragraphs and deleted the third in this section to reflect the installation of the containment building crane.

9.1.4.1.2 Miscellaneous Reactor Tools
Deleted references to miscellaneous reactor tools, replace with, "Because the reactor vessel will no longer be used, no special tools for maintenance or operation of the reactor vessel internals are required. Therefore, the discussion related to these tools has been deleted." This revision is being done to provide a current plant configuration.

9.1.4.1.3 Refueling Platform
Rewrote section as equipment formerly discussed was removed.

9.1.4.2 Transfer Cask
Rewrote section as equipment formerly discussed was removed.

9.1.4.2.1 Fuel Transfer Cask Safety Slings
Rewrote section as equipment formerly discussed was removed.

9.1.4.2.2 Fuel Transfer Cask Winch
Rewrote section as equipment formerly discussed was removed.

9.1.4.2.3 Fuel Transfer Cask Drop Analysis
Rewrote section as equipment formerly discussed was removed.

9.1.4.2.4 Fuel transfer Cask operability Requirements
Rewrote section as equipment formerly discussed was removed.

9.1.4.3 Fuel Handling
Paragraphs two and three deleted reference to the fuel transfer cask.

9.1.4.5 <u>Fuel Handling Control of Radiation Exposure (Reference EA-BRP-LEB-00-001)</u>

First paragraph: Add reference to EA-BRP-LEB-00-01 (SFP Surface Dose Rate During DFS Transfer Cask Loading, February 24, 2000) here and in the reference list at the end of the Chapter. Radiation exposure control items b. and c. revise as follows: "b. During transfer, the irradiated fuel will normally be under approximately 10 feet of water, with an expected minimum depth of 4 feet of water. C. The ungrappling operation will be done at a minimum depth of approximately 11 feet of water." A copy of the Engineering Analysis (EA) is provided, attached to GHRP comments. The EA was performed to determine depth of water needed during DFS transfer cask loading to keep dose rates ALARA.

Second paragraph: replace (containment closure provisions) during any fuel movement within containment with "during FUEL HANDLING as defined in the Defueled Technical Specifications." This wording is consistent with the Defueled Technical Specification wording.

Third paragraph, editorial revision, revised "provide" to "provides."

9.1.5.1 <u>Overhead Load Handling Systems – Cranes, Hoists, Lifting Devices (CLP) System</u>

Added a new first paragraph to reference removal of equipment lock crane.

Third paragraph, deleted reference to jib crane winch and transfer cask winch; these are removed.

Sixth paragraph; deleted discussion on equipment lock crane as it was permanently removed.

9.1.5.2 <u>Overhead Load Handling Safe Load Paths</u>

Revised second paragraph to discuss the containment building crane SER.

Added second from last paragraph to document 7/13/2001 commitment to mark the W100 Transfer Cask load path.

9.1.5.3 <u>Overhead Load Handling Procedures</u>

Added NOTE after first paragraph to define "in proximity."

Former third paragraph was deleted. New third paragraph (formerly the fourth paragraph) was revised. This was done to delete reference to the fuel transfer cask.

New fourth and fifth paragraphs were revised to discuss procedures.

The last paragraph was revised to indicate removal of the fuel transfer cask.

9.1.5.3 <u>Crane Operator Training</u>

Last sentence was revised to indicate one operator controller for the single-failure-proof crane.

9.1.5.5 <u>Special Lifting Devices</u>

New first paragraph was added to describe the Dry Fuel Storage lifting device qualifications.

Second paragraph was revised to delete obsolete lifting devices for fuel shipping cask.

Third paragraph was revised editorially for clarity.

9.1.5.6 <u>Overhead Load Handling Slings</u>

New first paragraph describes slings with the single-failure-proof crane.

Second paragraph, revised speed of crane hoist from 8 to 3 feet per minute.

Third paragraph, deleted fuel transfer cask sling references.

9.1.5.7 <u>Crane Inspection, Testing, and Maintenance</u>

First paragraph was revised to clarify the inspection intervals for the containment building (CBC)/reactor crane.

New third and fourth paragraphs were added, to specifically describe the new CBC inspection requirements.

Fifth paragraph added deleted reference to fuel transfer cask winch and reference to Defueled Technical Specification amendment 122 (Control of Heavy Loads.)

Sixth paragraph, discussion of reactor building crane, was revised to reflect initial load test of the single-failure-proof containment building crane.

9.1.5.8 Reactor, Loading Dock, and Turbine Building Crane Design
Added a NOTE at the beginning of the section to indicate discussion on the Equipment lock crane was informational since the crane was removed.

First paragraph, Second sentence, editorial change, deleted "Inc." after "Institute."

Second paragraph, added a new last sentence to include the new single-failure-proof crane in the design standards listed.

Third paragraph, rephrased the first sentence for clarity.

Added new sixth, seventh, eighth, and ninth paragraphs discussing the Facility Change for the Containment building crane and the associated SER for the Defueled Technical Specification amendment. These paragraphs replaced former discussion of the reactor building crane and associated modifications.

9.1.5.9 Interim Protection Measures (IPM) for Heavy Load Handling
Former second through seventh paragraphs were replaced with information on the single-failure-proof crane and deletion of the 24-ton fuel transfer cask.

9.1.6.1 Heavy Object Movement Analysis
Entire section was replaced with a revised first paragraph. Single-failure-proof crane installation eliminated former heavy object movement analysis considerations from the Spent Fuel Rack Addition Consolidation Environmental Impact Evaluation and description and Safety Analysis of April 1982.

9.1.7 CASK MOVEMENT / DROP ANALYSES

This section formerly discussed the 24-ton fuel transfer cask drop analyses. It was replaced with a paragraph discussing the single-failure-proof crane and administrative controls.

9.1.7.1 Fuel Transfer Cask
Final sentence was added to indicate the removal of this component.

9.2 WATER SYSTEMS

9.2.1.1, Service Water System Description,

First paragraph, revised "0740G40111" to "D740G40111"- editorial revision.

Third paragraph, remove water box vacuum pump. The Condenser water box vacuum pumps were removed in DWP-TCB02D (Turbine Deck General Area.) Components were available for decommissioning.

Fourth paragraph, editorial revision. Moved former last sentence and to current second sentence.

Last paragraph, revise, "...where the water mixes with the discharge from the service water system." to "...where the water mixes with the discharge from the circulating water pump, if the circulating water pump is running." This paragraph reflects Minor Alteration (MA) 99-0049 - Re-Powering of Circulating Water System Pump for Liquid Radwaste Batching. The MA re-powered the circulating water pump #1 and re-routed the main circulating water piping (due to demolition of the main condenser.) The MA was performed to provide dilution capability for liquid radwaste batch releases. It interfaced with DWP-TBA04C. During condenser removal, the circulating water pump discharge was disconnected from the plant discharge canal. This minor alteration re-connected the #1 pump for radwaste batch releases. It was included in Revision 9 to the UFHSR. This section was not changed with the Minor Alteration.

9.2.3 DEMINERALIZED WATER SYSTEM
Motor was replaced in MA-00-0034 with a 3 hp motor.

9.2.1.4.3 Loss of Service Water Evaluation
Editorial revision, deleted reference to Defueled Technical Specifications.

9.2.4 WELL WATER SYSTEM (WWS) AND DOMESTIC WATER SYSTEM (DWS)
This section was revised. Well water function is to keep the MDG cooling water pump primed, not to cool it. There is no backup cooling for the Main Diesel Generator. This corrects an inaccurate statement. Well water to the MDG is for priming the cooling water pump only.

9.3 PROCESS AUXILIARIES

9.3.2 Process Sampling System
This section described in the Offsite Dose Calculation Manual. The Off-Site Dose Calculation Manual is incorporated by reference in the Defueled Technical Specifications. Revision "Technical Specifications" to "Off-site Dose Calculation Manual."

9.4 HEATING AND VENTILATION SYSTEMS (VAS)

Entire section was re-written to reflect current plant configuration.

9.4.1 CONTROL ROOM AREA VENTILATION SYSTEM
Section was deleted.

9.4.2 SPENT FUEL POOL VENTILATION SYSTEM
The entire section was rewritten to reflect current plant configuration. The current first paragraph, last sentence deleted reference to "normal Plant Operations." Second paragraph, editorial revision "D0740G40125" was revised to "D740G40125."

9.4.3 RADWASTE AREA VENTILATION SYSTEM
Former last paragraph was deleted. First paragraph was revised to describe current configuration.

9.4.5 ENGINEERED SAFETY FEATURES VENTILATION SYSTEM
Editorial revision, second sentence.

9.4.6 CONTAINMENT SPHERE VENTILATION
First paragraph was revised to state the section was reviewed for configuration during decommissioning.

Second paragraph deleted specific containment pressure, which is no longer applicable.

Fifth paragraph added a discussion of the high efficiency particulate activity (HEPA) filter.

9.5 OTHER AUXILIARY SYSTEMS

9.5.1.1 Fire Detection Instrumentation

Editorial revision; first paragraph, deleted second period at the end of the last sentence.

Sixth paragraph, Surveillance Required, editorial revision; deleted the word "except" after "functional test."

9.5.3.1 Appendix R – Emergency Lighting
Editorial revision, revised spacing between sections.

Chapter 9 References: Added two new references.

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Chapter 11 RADIOACTIVE WASTE MANAGEMENT

Evaluated on Quality Review Form Log # 182-00, 198-00, 287-00, 451-00, 718-01, 289-02, and 290-02.

BACKGROUND INFORMATION
Spent fuel blades were deleted; they were shipped as Class B waste.

Deleted reference to the Concentrator Tank (MA-99-0065) as it is no longer available for resin storage.

Solid Waste Management system description was re-written to clarify the temporary storage of resins in high integrity containers (HICs) (MA-99-0065)

Revised the table on classification and volume projections – all greater than class C waste is currently located in the spent fuel pool.

Minor Alteration (MA) MA-01-0031 removed the service water return from the containment building as part of the decommissioning and dismantlement activities.

Revised a section to describe current ventilation flow.

Added a description of the Bulk Material Program approved by the NRC on February 5, 2002.

Incorporated editorial changes in several sections.

CHAPTER 11 REVISIONS
Entire Chapter 11, RADIOACTIVE WASTE MANAGEMENT, was issued in Revision 10 of the UFHSR for clarity, to avoid problems with page renumbering, and to ease text formatting.

Table of Content, was revised in Revision 10 and updated (Revision 10 in the upper right hand corner of each page.) Added new Section 11.4.4.

11.1 SOURCE TERMS
Second paragraph, first sentence, "mrems" was revised to "mrem." – editorial revision.

11.1.3 HIGH INTEGRITY CONTAINER (HIC) RESIN FIRE
Fourth paragraph, "dose" was changed to "doses" and "PAG's" was changed to "PAGs" – editorial revisions.

11.2.2 SYSTEM DESCRIPTION (Liquid Waste)
Sixth paragraph, first sentence, chemistry laboratory was deleted. It has been dismantled.

11.3.1 DESIGN BASES (Gaseous Waste)
Second paragraph, second from last sentence, deleted reference to chemistry laboratory fume hood exhaust; it has been dismantled.

11.3.2 SYSTEM DESCRIPTION (Gaseous Waste)
Deleted a line prior to section title.

Second paragraph, first line, added "D" before drawing numbers (decommissioning drawings.)

Second paragraph, Deleted former third from last sentence on ventilation flow.

11.4.2 SYSTEM DESCRIPTION (Solid Waste)
First paragraph – re-wrote to discuss storage of resins, GTCC waste storage and reflect current plant configuration.

Second paragraph deleted reference to the use of the concentrator tanks to store resins or filter media. Revised sentence on HICs to indicate they are used until resins or filter media can be shipped.

Deleted third paragraph that discussed the use of the fuel transfer cask, which was removed from service.

Minor editorial change to paragraph 4 (now 3). Added "which is" after Radwaste Building in the first sentence.

Deleted paragraph 5. Other non-compactable solid process is outlined in former seventh paragraph (now the last paragraph.)

Last paragraph, added non-compactable solids and approval by Radiation Protection rather than Health Physics.)

Table 11-3 DECOMMISSIONING WASTE CLASSIFICATION AND VOLUME PROJECTIONS
Deleted row on Nuclear Steam Supply System greater than class C waste – it is all stored in the spent fuel pool.

Hardware stored in Fuel Pool, Greater than class C, deleted Burial Volume and replaced it with this footnote, "Reference Federal Register Notice 10/11/2001 (66FR 15823). Effective November 13, 2991, interim storage of Greater than Class C (GTCC) waste was maintained under federal jurisdiction and is stored in a manner consistent with current licensing for the interim storage of spent fuel. "

11.4.4 BULK MATERIAL CONTROL PROGRAM
New section was added to describe the method for disposal of demolition waste accepted by the NRC on February 5, 2002.

11.5.1 DESIGN BASES (Liquid Waste)
Third paragraph, revised first sentence to delete "and other selected liquid streams." Sentence already discusses monitoring of plant liquid effluent streams. Deleted (former) sentence three on monitoring of non-effluent streams.

Table 11-4 Deleted row with RE-8290, service water was removed.

11.5.2 SYSTEM DESCRIPTION (Area, Process and Effluent Monitoring and Sampling)
Fifth, sixth and ninth paragraphs, corrected typographical errors, upper case letters revised to lower case.

Eleventh paragraph, deleted "C. Service Water Return From Containment Building" as a liquid process stream that is monitored.

Thirteenth paragraph, first sentence, revised "three(3)" to "two(2)"

11.6 <u>DISCHARGE CANAL DREDGING MANAGEMENT</u>
Added date of expiration to paragraph three.

Chapter 12 RADIATION PROTECTION

Evaluated on Quality Review Form Log # 24-01, 146-01, 648-01, 757-01, and 291-02

BACKGROUND INFORMATION

Cation and anion tanks were removed in Decommissioning Work Package (DWP) DWP-TBA-03.

Editorial changes were made.

CHAPTER 12 REVISIONS
Entire Chapter 12, RADIATION PROTECTION, was issued in Revision 10 of the UFHSR for clarity, to avoid problems with page renumbering, and to ease text formatting.

Table of Content, although not revised in Revision 10, was updated (Revision 10 in the upper right hand corner of each page) to eliminate user confusion on current revision of the Chapter.

12.1.1 POLICY CONSIDERATIONS
First Paragraph, editorial revisions to correct capitalized words.

Second Paragraph, Added reference to Section 12.5.1, UFHSR Chapter 13, and administrative procedures for definitions of personnel qualifications. Revised title of Radiation Safety Plan to Radiation Safety Program. Referenced plant procedures as location of the program.

Last Paragraph, changed radiation safety plan to radiation safety program

12.1.3 OPERATIONAL CONSIDERATIONS
Fourth paragraph, editorial revisions to correct capitalized words.

12.2.1 CONTAINED SOURCES
First paragraph, editorial, revised "which" to "that"

Second paragraph, deleted reference to control room as a shielded area.

Third paragraph, deleted information on control room shielding.

Fourth paragraph, Re-worded the first sentence to eliminated ambiguity.

12.2.2 AIRBORNE SOURCES
First paragraph, third sentence, revised tense ("is" to "was") to reflect historic information.

12.3.1 FACILITY DESIGN FEATURES
First paragraph, third sentence, added the word "the" before control room.

Discussion on Regulatory Guide 8.8, Part a, Access Control of Radiation Areas, first paragraph, third sentence "an" was revised to "on".

Discussion on Regulatory Guide 8.8, Part e, Crud Control, first paragraph, third sentence revised to clarify that remaining zircaloy is fuel clad (turbine condenser was removed.)

Discussion on Regulatory Guide 8.8, Part e, Crud Control, third paragraph, first sentence revised "exist" to "existed."

Discussion on Regulatory Guide 8.8, Part h, Resin and Sludge Treatment Systems, first paragraph, first sentence revised to reflect MA-99-0065 installation of a high integrity container (HIC) for sluicing resins.

Discussion on Regulatory Guide 8.8, Part h, Resin and Sludge Treatment Systems, NEW fifth paragraph was added to describe MA-99-0065 installation of a high integrity container (HIC) for sluicing resins.

12.3.2 SHIELDING
Second paragraph, last sentence, eliminated reference to cation and anion tanks, which have been removed.

Table 12-1 Location, Material, and Thickness of Major Shields.
Decreased thickness of Reactor Vessel (cavity) from 8 to 7 feet and added a reference to Facility Change FC-708.

Also revised "Pb" to "Lead" as Alternate Liquid Rad Waste Pre-filters thickness

12.4 <u>DOSE ASSESSMENT</u>
First paragraph, last sentence, revised 1992 to 2000.

Table 12-2 Big Rock Point Annual Occupational Radiation Doses
Added information to table for 1993 to 2000.

12.5.3 PROCEDURES (Heath Physics Program)
First paragraph, second from last sentence, capitalized "Technical Specification."

Detailed Listing of Revision 10 Changes
Addressed Section by Section
Attachment IV

Chapter 13 CONDUCT OF OPERATIONS

Evaluated on Quality Review Form Log #431-00

BACKGROUND INFORMATION

Revisions were due to incorporation of requirements from NEI-97-06, Appendix B, guidance document for 10 CFR 50.59 and 10 CFR 728 Evaluations.

Refueling transfer cask was removed due to Nuclear Regulatory Safety Evaluation Report (SER) (September 28, 2001, Big Rock Point Plant – Issuance of Amendment RE: Fuel Handling and Control of Heavy Loads and to Include the Removal of the Fuel Transfer Cask.)

CHAPTER 13 REVISIONS

Entire Section 13.5, PLANT PROCEDURES, was issued in Revision 10 of the UFHSR for clarity, to avoid problems with page renumbering, and to ease text formatting.

Table of Content, although not revised in Revision 10, was updated (Revision 10 in the upper right hand corner of each page) to eliminate user confusion on current revision of the Chapter.

13.5.1.4 Administrative Procedure Controls

First paragraph, last sentence was revised. 10 CFR 72.48 procedural controls were added for ISFSI and storage cask review of safety implications.

13.5.2.9 Fuel Handling Procedures

Eliminated last paragraph of the section. It addressed the refueling transfer cask safety cable functional testing of the safety catch device. This component was removed.

Detailed Listing of Revision 10 Changes
Addressed Section by Section
Attachment IV

Chapter 15 ACCIDENT ANALYSES

Evaluated on Quality Review Form Log #758-01

BACKGROUND INFORMATION

Chapter 15 was revised with the issuance of NRC SER dated 9/28/2001. The fuel transfer cask was removed from service.

CHAPTER 15 REVISIONS

Entire Section 15.10, DECOMMISSIOINING ACCIDENT CONSIDERATIONS, was issued in Revision 10 of the UFHSR for clarity, to avoid problems with page renumbering, and to ease text formatting.

Table of Content, although not revised in Revision 10, was updated (Revision 10 in the upper right hand corner of each page) to eliminate user confusion on current revision of the Chapter.

15.10.2.1 Previous Analyses of Fuel Handling Accidents
Fourth paragraph, last sentence, existing "transfer cask" was removed from the plant. Sentence was revised to reflect dry fuel storage fuel transfer components.

ATTACHMENT V

CONSUMERS ENERGY COMPANY
BIG ROCK POINT PLANT
DCKET 50-155 AND 72-043 – LICENSE DPR-5

REVISION 10 TO THE UPDATED FINAL HAZARDS SUMMARY REPORT
(UFHSR)
Submitted September 17, 2002

Informational Copy of Volume 32
Environmental Report for Decommissioning

BIG ROCK POINT NUCLEAR POWER PLANT
PROCEDURE APPROVAL AND AUTHORIZATION

Procedure No. VOLUME 32 Rev No. 0

Procedure Title: ENVIRONMENTAL REPORT FOR DECOMMISSIONING

CURRENT REVISION STATUS

Author TAGoble Date 09/11/01 Quality Review Form No. 384-01

APPLICABILITY ISSUE HISTORY

Revision No. ________ Date ________ Quality Review Form No. ________

Approved for use
Procedure Sponsor/Designate ________ Date 1/8/02

Authorized Period of Use September 11, 2001 through September 11, 2003

BEFORE USING THIS PROCEDURE FOR WORK ACTIVITIES, VERIFY WITH THE RESPECTIVE PROCEDURE CONTROLLING DEPARTMENT THERE ARE NO OUTSTANDING TEMPORARY CHANGES

INFORMATION COPY

When applicable:

PROCEDURE IMPLEMENTATION HISTORY
Reviewed for System or Component Operability

Performed by	Completed/Reviewed by	
Title	Title	Method of Verification
Date / Time	Date / Time	☐ Functional Test ☐ Physical Inspection ☐ Administrative Review

AMMS WORK ORDER NO. (if applicable) ________

TABLE OF CONTENTS/EFFECTIVE PAGES

TABLE OF CONTENTS/EFFECTIVE PAGES

1.0 INTRODUCTION

The Big Rock Point site is located on the shore of Lake Michigan, approximately four miles northeast of Charlevoix, Michigan. The Big Rock Point Nuclear Plant began commercial operation in December 1962 as a boiling water reactor designed by General Electric Company. The plant was rated to produce 75 MWe. The plant ceased operation on August 29, 1997.

1.1 PURPOSE

The purpose of the Environmental Report is to present an evaluation of the environmental impacts resulting from the decommissioning of Big Rock Point, including decontamination and dismantlement activities. The Environmental Report addresses actual or potential environmental impacts associated with decommissioning activities. The Environmental Report is prepared pursuant to 10 CFR 50.82 to support license termination. Consumers Energy did not prepare an original environmental report for Big Rock Point construction because it was not required under the original plant license.

1.2 REGULATORY BASIS

Decommissioning of commercial nuclear power plants is a regulated process whereby the radioactive materials contained in structures, systems, components and portions of the site are reduced to residuals levels, and the 10 CFR Part 50 license is terminated by the U.S. Nuclear Regulatory Commission (NRC). The voluntary termination of the Part 50 license requires NRC approval as currently specified in 10 CFR 50.82.

The Environmental Report has been prepared in accordance to 10 CFR 51.53(b) and guidance provided in the NRC's Final Generic Environmental Impact Statement (FGEIS) for nuclear facilities [Reference 1.2-1].

1.3 FINAL RELEASE CRITERIA

Big Rock Point plans to meet the criteria of 10 CFR Part 20 for release of the plant property for unrestricted use. Under these criteria, the limit for dose to an average member of the critical population group will not exceed 25 millirem in any year for the following 1000 years due to residual contamination of plant origin. Discussion of final release criteria is provided in Section 4.2.1.

1.4 SUMMARY AND CONCLUSIONS

This Environmental Report demonstrates that the decommissioning of Big Rock Point will not result in any significant impact to the environment. On the contrary, decommissioning and restoration of the Big Rock Point site will result in a positive benefit to the environment. The following is projected during the decommissioning of Big Rock Point:

a. Annual occupational radiation exposures per individual will be maintained below historical levels for the operating phase of the plant.

b. All effluents, both radiological and non-radiological, will remain within regulatory limits throughout the decommissioning process.

c. Exposure to onsite workers and the offsite public as a result of waste transportation is expected to be maintained well below the levels projected by the FGEIS.

d. Following decommissioning, residual radioactivity will be limited to allow release of the property for unrestricted use such that an individual of a critical population group living on the site would not be expected to receive a dose greater than 25 millirem/year from all combined environmental exposure pathways.

1.5 REFERENCES

a. 1.2-1, Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities, NUREG-0586, U.S. Nuclear Regulatory Commission, dated August 1988

2.0 INTRODUCTION

This chapter presents a summary description of the decommissioning activities and the schedule for decommissioning and dismantlement activities at Big Rock Point. The information presented in this chapter reflects initial planning of decommissioning activities. Prior to initiating each decommissioning activity, detailed planning, including engineering design and ALARA considerations, is performed.

Consumers Energy's goal is to dismantle Big Rock Point plant in a safe, environmentally conscious, and cost effective manner. This action will result in the timely removal of existing nuclear plant systems and structures in accordance with the DECON option found acceptable to the NRC in its Final Generic Environmental Impact Statement. Completion of the option is contingent upon continued access to one or more low level waste disposal sites.

2.1 PLANT DISMANTLEMENT

The dismantlement period is expected to result in the complete removal of plant facilities followed by restoration of the plant industrial area. The facilities remaining to support dry fuel storage will be decontaminated and/or dismantled after the spent fuel has been transferred/shipped to another facility [Reference 2.1-1]. The completion of the dismantlement period is confirmed by a successful final radiation survey verifying radioactivity has been reduced to residual levels to allow unrestricted release of the property in accordance with 10CFR50.82 and associated NRC guidance documents.

2.2 SITE RESTORATION

During the site restoration period it is expected that any remaining plant structures will be demolished and removed, foundations backfilled, and the site graded and landscaped.

2.3 SCHEDULE FOR DECOMMISSIONING ACTIVITIES

The Big Rock Point decommissioning schedule is presented in Figure 2.3-1. Activity phases are discussed further in Section 4.1.1 with respect to estimates of occupational radiation exposure.

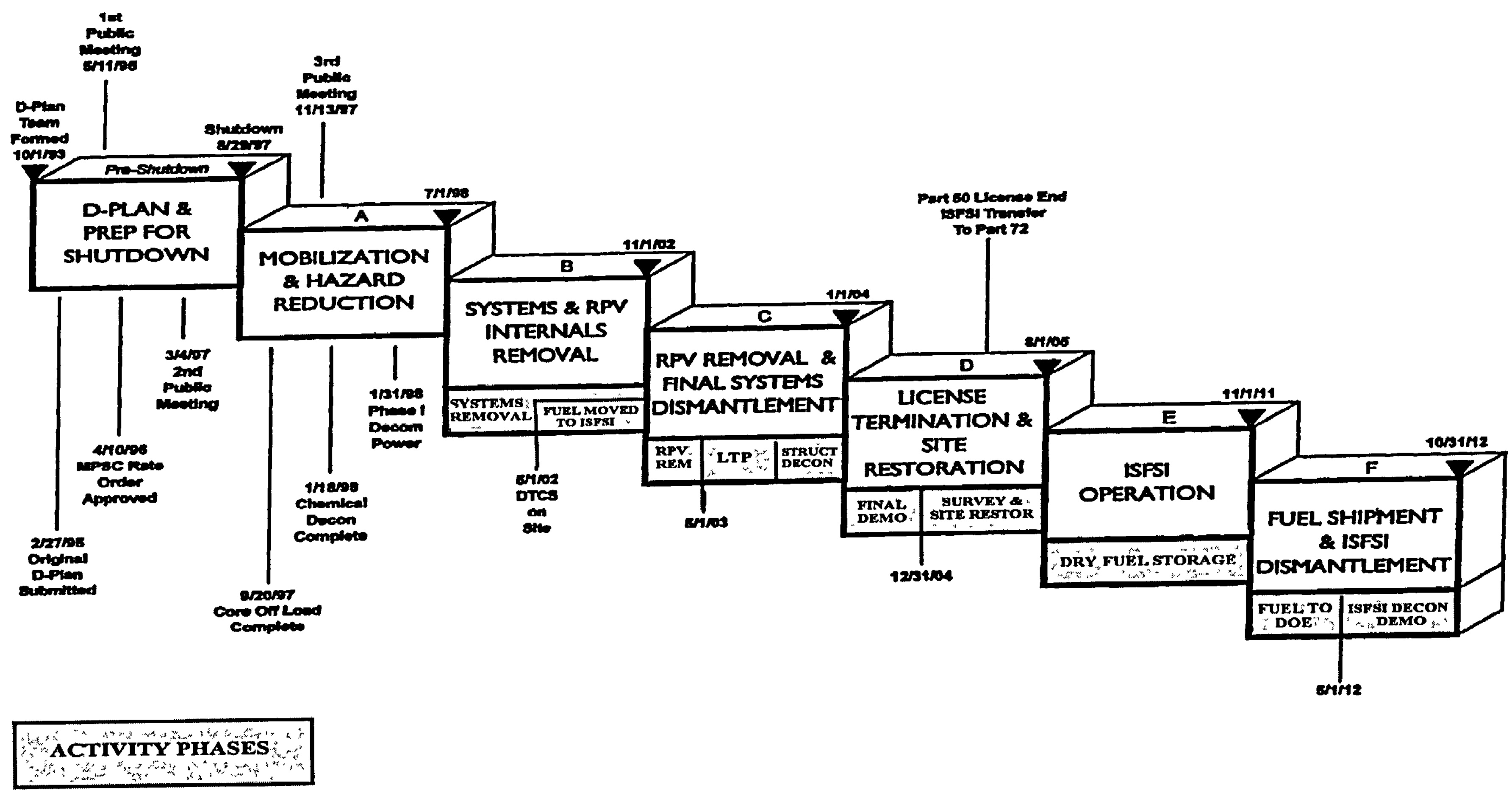
2.4 DECOMMISSIONING WORKFORCE

The workforce in the dismantlement and site restoration phases is predominantly contracted due to the specialized nature of the work; however, Consumers Energy maintains full responsibility and accountability throughout decommissioning in addition to retaining a core staff to oversee decommissioning activities.

2.5 REFERENCES

a. 2.1-1, Big Rock Point Plant Post Shutdown Decommissioning Activities Report

Figure 2.3-1
Big Rock Point Decommissioning Timeline Major Periods



3.0 INTRODUCTION

The following sections characterize the external environment interfacing with Big Rock Point Restoration Project. Topics consist of geography and demography, terrestrial and aquatic ecology, meteorology, hydrology and geology. Also included are descriptions of trends and changes to these features observed over the term of the operating license. These factors form the basis for assessing the potential environmental impact of decommissioning Big Rock Point Nuclear Plant.

3.1 GEOGRAPHY AND DEMOGRAPHY

This section describes the general site location, land and features immediately surrounding Big Rock Point site in terms of human occupancy and uses.

3.1.1 Site Location and Description

The Big Rock Point site is located on the northeast shore of Lake Michigan in Charlevoix County in the northern part of Michigan's Lower Peninsula. The site is approximately 60 miles northeast of Traverse City, Michigan and 225 miles north-northwest of Detroit. The closest population centers are the cities of Charlevoix, 3.5 miles southwest, and Petoskey, 11 miles east of the plant site. The site is owned by Consumers Energy and occupies approximately 570 acres. Figure 3.1-1 depicts the property boundaries and owner-controlled area. The owner-controlled area is identical to plant property boundaries, except where US Route 31 traverses plant property. In those locations US Route 31 bounds the owner-controlled area. Access to the site is available via US Route 31 which bounds the owner-controlled area at a distance of one-half mile. US Route 31 connects the cities of Charlevoix and Petoskey.

The site boundary may change as areas are evaluated and removed from the site description in the UFHSR prior to license termination. The site boundary will, at a minimum, continue to include the current industrial area plus a buffer zone sufficient to assure complete radiological control within the reduced site area. Section 6.2, Radiological Site Characterization, contains a preliminary classification of site property based on radiological status.

The area immediately surrounding the plant industrial area is wooded and gently sloping. There are no significant topographic features near the plant. Approximately three miles to the south are Lake Charlevoix and Round Lake, inland extensions of Lake Michigan. Lake Charlevoix occupies approximately 27 square miles while Round Lake is a small natural harbor connecting Lakes Michigan and Charlevoix. A small stream, Susan Creek, exists to the east of US Route 31 and drains into Lake Michigan east of the owner-controlled area boundary.

There are no residences or commercial facilities within one-half mile of the containment building. Scattered rural and resort residences and a few commercial facilities are found within three miles of the site. Significant commercial and residential areas exist in the cities of Charlevoix and Petoskey. Industrial activity in the vicinity of Big Rock Point consists primarily of small manufacturing facilities. A small plastics manufacturer, employing approximately 150 people, is located to the east, adjacent to plant property. An operating cement plant with a quarry is located about six miles to the southwest. A large housing and recreational complex is located about nine miles to the east of the Big Rock Point site.

3.1.2 Population Distribution

The following sections describe the population distribution in areas near Big Rock Point.

3.1.2.1 Existing Population

The areas near Big Rock Point are generally rural to suburban. The northern part of Michigan attracts tourists year round making seasonal population fluctuation in the vicinity of the plant an important consideration. Peak seasonal visitation occurs in the summer months (June through August) with corresponding population increases in Charlevoix and Emmet counties of up to 75% [Reference 3.1-1].

The permanent residential population within the five-mile radius is approximately 3,800 and includes a portion of the city of Charlevoix. The permanent residential population within 50 miles is approximately 195,000 [Reference 3.1-3]. Tables 3.1-1 and 3.1-2 provide the approximate permanent residential population distribution within five miles and 50 miles of the plant, respectively. Table 3.1-3 gives the permanent population history of the various municipalities whose borders are within 50 miles of the plant. Table 3.1-4 provides population data since 1960 for the three counties closest to the plant. The closest city with a residential population in excess of 25,000 (population center as defined by 10 CFR Part 100) is Sault Ste. Marie, Ontario, Canada, located approximately 100 miles from the plant. Traverse City, Michigan, approximately 50 miles to the south, does not have a population of greater than 25,000 within its incorporated boundaries, but the greater metropolitan area does exceed 25,000.

3.1.2.2 Projected Population

Based on the values in Table 3.1-3, the populations of cities near the plant (Charlevoix, Petoskey, Harbor Springs, Boyne City and East Jordan) have experienced slight increases. The average population increase for these five municipalities is 11% over 40 years or approximately 0.3% per year. The remaining municipalities in Table 3.1-3 have shown steady declines in population since 1960. The average annual population increase for the three surrounding counties (Charlevoix, Antrim and Emmet) is approximately 105% (Table 3.1-4). These significant increase in residential populations in rural areas is consistent with and overall trend recognized across the country of movement from urban to suburban or rural areas. Projected population growth rate for the regional area is expected to remain relatively constant making it unlikely that a population center in excess of 25,000 will exist within 50 miles of the plant site in the next several decades.

3.1.3 <u>Uses of Adjacent Land and Waters</u>

The following sections describe land and water use by inhabitants in the vicinity of Big Rock Point.

3.1.3.1 Land Use Within Five Miles

The general land use surrounding Big Rock Point is shown in Figure 3.1-2. Vegetation in this area consists largely of wooded areas and open fields. Farming in the area is limited due to nutrient-poor agricultural soils. Commercial land use consists primarily of small businesses in the city of Charlevoix. There are several small industrial sites within the five-mile radius. Several medium-density residential developments are located to the east of the plant. The remainder of residential and vacation homes are scattered throughout the area. There are also a variety of public recreation areas located within five miles of the plant.

a. Major Bodies of Water

The primary body of water in the vicinity of the plant is Lake Michigan. Lake Michigan has a surface area of approximately 22,300 square miles and a maximum recorded depth of 923 feet. To the south, at a distance of about three miles, is Lake Charlevoix, an inland extension of Lake Michigan. To the east of the plant is Susan Creek, which flows from Susan Lake north into Lake Michigan. Lake Charlevoix has a surface area of about 17,000 acres, while Susan Lake has a surface area of about 130 acres.

b. Commercial/Industrial Areas

The majority of commercial land use occurs in the city of Charlevoix, located approximately 3.5 miles southwest of the plant. Several residential areas are also located in the city of Charlevoix. A small industrial park of less than 10 small businesses and a 58-room hotel are located 2.5 miles southwest of Big Rock Point. The Charlevoix Area Hospital is located 4 miles southwest of the plant. Refer to Figure 3.1-2 for approximate locations of commercial/industrial facilities.

c. Schools

There are four schools within five miles of the plant (see Figure 3.1-2). Charlevoix Elementary, located about three miles southwest of the plant, had 627 students enrolled during the 1999-2000 school year. Charlevoix Middle School and St. Mary's School are located in the downtown area and have an enrollment of 317 and 103 students, respectively. Charlevoix High School is just within the five-mile radius of the plant and has 424 students enrolled [References 3.1-5, 3.1-6].

d. Farms

Land use for farming is limited in the vicinity of Big Rock Point primarily due to nutrient-poor agricultural soils. Approximately 16% of Charlevoix county is used for farming [Reference 3.1-7]. Investigations with local agencies indicate a total of approximately 2600 acres of farmland within five miles of the plant [Reference 3.1-8]. Consumers Energy personnel have conducted surveys to determine locations of the nearest residence, gardens greater than 500 ft^2, and livestock use by sector. The results of the 1998 survey are summarized in Table 3.1-5. These locations may include farms or simply garden plots or livestock used for private consumption [Reference 3.1-9]. Figure 3.1-2 shows the approximate locations of farms, gardens and livestock within five miles of the plant.

e. Public Lands/Conservation Areas

Several public lands and conservation areas within five miles of the plant offer a variety of recreational opportunities including fishing, hunting, boating, swimming, hiking, picnicking and golfing. Waterfront recreational areas include the Mt. McSauba Recreation Area, Lake Michigan Beach, Depot Beach and Ferry Avenue Beach located on Lake Charlevoix, in addition to several public and private marinas also located on Lake Charlevoix [Reference 3.1-2]. In the vicinity of the plant, both Lake Charlevoix and Lake Michigan are used extensively for recreational fishing. There are two golf courses within five miles of the plant; both of these courses are located along US Route 31 between Big Rock Point and the city of Charlevoix. Approximately 1.5 acres just west of the plant is owned by the Little Traverse Conservancy. This land includes 500 feet of Lake Michigan shoreline, reserved as a natural habitat and receives minimal public use [Reference 3.1-10]. South of US Route 31 approximately 100 acres are owned by the Charlevoix Rod and Gun Club. In addition, passive recreational use of much of the land owned by Consumers Energy outside the plant protected area is allowed.

Figure 3.1-2 shows the locations of public lands listed above as well as the locations of recreational facilities within five miles of Big Rock Point.

f. Historic Areas

The Michigan Historic Preservation Office has no record of any archaeological sites on the Big Rock Point property. There are recorded archaeological sites along and near the shoreline in the surrounding region, including a site to the east of the plant, two sites in the Nine-Mile Point vicinity, and one site to the west near North Point [Reference 3.1-11]. While most decommissioning activities are not expected to impact plant property outside the general area of buildings and facilities, a Phase 1 archaeological survey of the potentially affected plant property was conducted in 2000 assessing the historic significance of previously undisturbed site land [Reference 3.1-14]. This study identified seven prehistoric archaeological sites within the Big Rock Point property boundary. The significance of these sites is still under evaluation by the Michigan Historic Preservation Office pending completion of a Phase II archeological study; it is expected that this evaluation will be completed prior to release of the site for unrestricted use [Reference 3.1-15].

g. Transportation Routes

US Route 31 connects the cities of Charlevoix and Petoskey and provides access to the plant. A small airport serving the area is located outside the five-mile plant radius, south of Charlevoix along US Route 31.

3.1.3.2 Water Supplies

Water supplies near Big Rock Point generally consist of private residential and commercial wells or well systems serving small residential communities. The city of Charlevoix obtains water directly from Lake Michigan. The city water intake is located approximately four miles from the plant, west of the Pine River Channel connecting Lake Michigan and Round Lake.

The resort/residential community of Nine-Mile Point, located three miles northeast of the plant, obtains its water supply from two wells serving approximately 28 households. Lake Michigan Heights, located about four miles east of the plant, has two wells with the capacity to provide water for 63 home sites. The domestic water supply for LexaLite Corporation, located just east of the plant, is provided by a single well. This well is classified as a Type IIB public water supply serving greater than 25 people more than 60 days per year [Reference 3.1-12].

The well water system at Big Rock Point plant provides water for domestic services and backup cooling for the main diesel generator. This well is located approximately 800 feet east of the plant at a depth of 135 feet. The deep-well pump draws water from the well into a well-water storage tank via a two-inch line at flow rates up to 79 gpm. As system needs dictate, water is pumped from the storage tank by the domestic water pump to the system accumulator.

A sanitary survey of the water supply system was performed in 1988 by the Michigan Department of Public Health and the system is in compliance with Federal Safe Drinking Water Act and Michigan Safe Drinking Water Act (Act 399) requirements. Comprehensive chemical analyses of the water for metals, volatile organics and synthetic organics were performed in 1988 and no contaminants were detected [Reference 3.1-13]. Annual water quality testing for contaminants continues in accordance with state and federal requirements. There are no abandoned wells on plant property.

3.2 ECOLOGY

The data presented in this section describe regional aquatic and terrestrial ecological conditions near Big Rock Point and corresponding occupancy by non-human species. The data reflect a thorough investigation of existing sources of area ecological information.

3.2.1 Aquatic Ecology

The following section describes the general aquatic ecology for the region near the Big Rock Point site, including water quality and aquatic flora and fauna.

3.2.1.1 Water Quality

The Big Rock Point site is located on the northeast shore of Lake Michigan, west of Little Traverse Bay. In general, the northern portion of Lake Michigan, including Little Traverse Bay, can be characterized as an oligotrophic lake considered to have excellent water quality [Reference 3.2-1].

Periodic analyses have been performed on Lake Michigan waters in the vicinity of the plant. Water quality data contained in the following sections reflect analyses performed on Lake Michigan waters near the plant discharge canal, in Little Traverse Bay, and outside the Pine River Channel leading from Round Lake to Lake Michigan (referred to hereafter as the Charlevoix Harbor area). Water quality information obtained from these locations is fairly consistent and is a reasonable representation of Lake Michigan water quality in this region.

Table 3.2-1 is a composite summary of physical and chemical water quality parameters obtained from the various sources and locations. Figure 3.2-1 shows the approximate water sampling locations.

a. Physical Parameters

The physical parameters reviewed include temperature, conductivity, turbidity, and particulate content.

1. Temperature

During the warmer months the vertical temperature profile in Lake Michigan reflects the phenomenon of stratification, where cooler, more dense water is located at lower depths and the warmer, less dense water is found at the surface. In the spring soon after the ice melts, the entire volume of the lake is essentially at the same temperature. In the fall, wind blowing across the lake surface creates circulation patterns that cause the lake to mix or "turn-over." Lake turn-over can account for several degrees of temperature variation over a period of days. Lake Michigan temperatures near Big Rock Point typically range from approximately 70° F at the surface during the summer to 33° F during the winter [Reference 3.2-2]. Ice cover on the lake is usually present from January to April.

2. Conductivity

Conductivity, a measure of water's electrical conductance, increases as the amount of dissolved substances in the water increases. Most of northern Michigan's lakes are considered "hard" water lakes and have conductivities in the range of 250-300 µmho/cm [Reference 3.2-3]. The conductivity values given in Table 3.2-1 for Lake Michigan fall within this range.

3. Turbidity

Table 3.2-1 shows turbidity or Secchi Disk measurements for the three sampling locations. Turbidity levels near the plant are quite low (less than 0.5N Turbidity Units), indicating high water quality. Secchi Disk readings, an alternate measure of water clarity, are affected by suspended matter and water color. Secchi Disk measurements of approximately 20 feet in Little Traverse Bay are consistent with the low turbidity measurements in the vicinity of Big Rock Point site. In contrast, Secchi Disk readings taken in the Charlevoix Harbor area are significantly lower (5.2 feet). Probable explanations for this reduced clarity are the higher boating activity levels and wave action in the Pine River Channel resulting in increased turbulence and suspended matter.

4. Particulate Content

Concentrations of Total Suspended Solids (TSS) and Total Dissolved Solids (TDS) were measured near the plant discharge canal and are presented in Table 3.2-1. The low TSS content (less than 1 mg/l) is consistent with the low turbidity, high clarity values cited previously. The TDS content is relatively high (212 mg/l) and is directly related to the water's conductivity.

Chlorophyll-a is found in all forms of algae and provides an indication of the quantity of phytoplankton production. In general, oligotrophic lakes with low nutrient contents do not support significant levels of algal growth. The chlorophyll-a content in this region of Lake Michigan is fairly low, approximately 2.8 mg/l [Reference 3.2-4].

b. Chemical Parameters

The chemical parameters investigated include dissolved oxygen, pH and alkalinity, nutrient content, and chloride levels.

1. Dissolved Oxygen

Dissolved oxygen content for this region of Lake Michigan ranges from 8.8 mg/l to 13.1 mg/l (see Table 3.2-1). Since dissolved oxygen levels are temperature dependent, the time of year and depth of measurement most likely accounts for this variation. In general, waters with dissolved oxygen contents above 5 mg/l support higher-level aquatic life [Reference 3.2-4].

2. pH and Alkalinity

The pH measurements for all three sampling locations were 7.9, see Table 3.2-1. Lakes in northern Michigan are typically slightly alkaline due to the limestone bedrock and glacial till in the area. An alkalinity of 105 mg/l in Little Traverse Bay is relatively high, indicating resistance to acidic input [Reference 3.2-3].

3. Nutrient Content

Nitrogen is present in natural waters in many forms, most commonly as ammonia and nitrate/nitrite. Low concentrations, less than 1 mg/l, of the various forms of nitrogen indicate good water quality [Reference 3.2-4]. Table 3.2-1 provides ammonia and nitrate/nitrite concentrations for the three sampling locations; the values are all considered very low.

Phosphorus is generally the least abundant nutrient in most regional lakes and controls the amount of algal growth. Phosphorus concentrations in the range of 10-20 mg/l are indicative of good water quality [Reference 3.2-3]. The phosphorus values in Table 3.2-1 range from 0.005-0.11 mg/l, which indicates excellent regional water quality.

4. Chloride Level

Chloride concentration in lakes is an indicator of human influence. Common sources of chloride include septic systems, waste water treatment plants, industrial discharges, road salt, and fertilizers. Seasonal variations in chloride levels are often observed in the area. Background levels for chloride in northern Michigan's surface waters are generally less than 10 mg/l [Reference 3.2-3]. Table 3.2-1 shows chloride concentrations in the area below typical background levels.

3.2.1.2 Flora

No current data are available on aquatic flora near the Big Rock Point site. Results of several Lake Michigan near-shore water studies indicate that the year-to-year distribution of phytoplankton throughout Lake Michigan is relatively constant with expected seasonal variations. Diatoms are typically the dominant species while blue-green algae are generally present in very low numbers [Reference 3.2-7].

3.2.1.3 Fauna

The following subsections characterize aquatic biological communities in the vicinity of Big Rock Point. Characterization of aquatic biological communities focuses on Lake Michigan and Lake Charlevoix.

a. Benthos

No current data are available on the benthic macroinvertebrates inhabiting the near-shore waters of Lake Michigan in Charlevoix County. Data collected in the early 1970s indicate the benthos of the area consists primarily of amphipods, midges and pollution-tolerant oligochaetes [Reference 3.2-8].

b. Ichthyoplankton

The general, the littoral mainland area of Lake Michigan has potential spring and summer spawning grounds for several species of fish. However, the immediate vicinity of Big Rock Point has not been identified by the US Fish and Wildlife Service as a critical spawning ground [Reference 3.2-9]. The site does not represent a unique or specialized niche for colonization or ecological activities, and the habitat is typical of the northern part of Lake Michigan's lower peninsula shoreline.

In 1971, the Grosse Isle Laboratory of the Environmental Protection Agency (EPA) conducted a study to determine if whitefish or lake trout eggs were drawn into the cooling water intake of the Big Rock Point. The study found no eggs passing through the Big Rock Point intake structure [Reference 3.2-10].

c. Fishery Resources

1. Adult and Juvenile Fish

Popular sport fish found in Lake Charlevoix and the Charlevoix County area of Lake Michigan include: lake trout (*Salvelinus namaycush*), coho salmon (*Oncorhynchus kisutch*), chinook salmon (*Oncorhynchus tshawytscha*), rainbow trout (*Oncorhynchus mykiss*), pink salmon (*Oncorhynchus gorbuscha*), brown trout (*Salmo trutta*), walleye (*Stizostedion vitreum*), channel catfish (*Ictalurus punctatus*), burbot (*Lota lota*), yellow perch (*Perca flavescens*), lake whitefish (*Coregonus clupeaformis*), smallmouth bass (*Micropterus dolomieu*), largemouth bass (*Micropterus salmoides*), northern pike (*Esox lucius*) and sunfish (*Lepomis spp*). Fishing for these species is popular from a variety of craft, as well as from shore, breakwater and piers, and at the plant discharge canal. Creel information for Charlevoix, Michigan is provided in Table 3.2-2.

The Michigan Department of Natural Resources (MDNR) and the United States Fish and Wildlife Service maintain fish stocking programs in Lake Michigan and Lake Charlevoix. In recent years stockings include lake, rainbow, brown and brook trout, and chinook and coho salmon [Reference 3.2-11].

2. Commercial Fishery Resources

Commercial fishing in Lake Michigan near Big Rock Point is regulated under the terms of the 1985 negotiated settlement involving Native American tribes, the State of Michigan and the US Department of Interior [Reference 3.2-13]. Currently, three northern Michigan tribes, operating under the regulation of the Chippewa/Ottawa Treaty Fishery Management Authority (COTFMA), fish in the treaty-ceded waters of Lake Michigan (Figure 3.2-2). The three tribes involved are the Sault Ste. Marie Tribe of Chippewa Indians, Bay Mills Indian Community and the Grand Traverse Band of Ottawa/Chippewa Indians. The area of Lake Michigan near the Big Rock Point is considered a "transition zone", and no tribal commercial fishing is allowed for the periods from June 1 to September 30 and November 1 to December 31. Under the provisions of this treaty the region of Lake Michigan near Big Rock Point is designated as a primary lake trout rehabilitation zone.

Tribal commercial landings of all species combined from Lake Michigan reached a record high of 3.55 million pounds in 1988; an increase of 320,000 pounds from 1987 and 1.23 million pounds from 1986. Lake whitefish is the most important commercial species, comprising 72% of the total catch. Bloater chubs comprise 9%, lake trout comprise 8% and menominee comprise 5%; the remaining 6% was not categorized.

Chinook salmon are also commercially harvested from weirs on tributaries of Lake Michigan [Reference 3.2-14]. Total harvest was 364,854 pounds in 1991; 330,120 pounds in 1992; and 251,816 pounds in 1993 (Table 3.2-3). One of the harvest weirs is located in Medusa Creek near the city of Charlevoix.

3. Forage Fish

Forage fish stocks in Lake Michigan include such species as alewife, smelt, bloater chubs and sculpins. The Great Lakes Center of the National Biological Survey (formerly US Fish and Wildlife Service) has conducted lake-wide surveys of the major forage fish species in Lake Michigan each fall since 1973. The surveys provide data on relative abundance, age and size structure, and condition of individual fish used to estimate various population parameters needed for managing the stocks [Reference 3.2-15]. The relative abundance of alewife, smelt and bloaters from 1973 to 1993 is shown in Figure 3.2-3. Relative abundance of adult bloaters, smelt and alewives all decreased in 1993. Estimated total biomass of forage fish available to bottom trawls in Lake Michigan was 322,000 metric tons in 1993 compared to 476,000 tons in 1992 and consisted of 72.7% bloaters, 11.5% alewives, 4.0% rainbow smelt and 11.8% sculpin (Figure 3.2-3).

4. Fishery Resources near Big Rock Point

As part of the Radiological Environmental Monitoring Program, fish or crayfish samples are collected twice per year at the shoreline near the Big Rock Point discharge canal. A list of species typically collected is provided in Table 3.2-4, and the results of the radiological analyses are provided in Section 4.1.

3.2.2 Terrestrial Ecology

Terrestrial biological communities onsite are located on level to gently sloping lake plain soils that are cobbly and gravelly. Most of the site property is composed of woodlands, with limited openland acreage that is converting to forest. Both sand and stone beaches occur onsite. Soils on the property are in the Detour-Kiva association. These soils are very poorly suited to both farming and silvicultural practices. The following sections describe soil, terrestrial plant and wildlife in the vicinity of Big Rock Point.

3.2.2.1 Soils

Biological communities onsite are strongly influenced by soil conditions that limit not only farming but also silvicultural and wildlife management potential. The soil survey of Charlevoix County, Michigan, includes all site soils in the Detour-Kiva association [Reference 3.2-16]. Soil types and their onsite acreage are listed on Table 3.2-5 and depicted in Figure 3.2-4. Each soil type is discussed individually below[1]:

a. AgB - Alpena gravelly-sandy loam, 0-6% slopes, comprises 184.7 acres (32.6% of the plant property). This is a soil of beach ridges and terraces. Onsite, this soil is found predominantly in a band about a quarter-mile wide along the beach ridges and terrace adjacent to Lake Michigan. The plant and its grounds are located on this soil type. Permeability is rapid, natural fertility is low, organic content is moderately low. Undeveloped areas of this type onsite are forested.

b. DeB - Detour cobbly loam, 0-6% slopes, comprises 227.9 acres (40.2% of the plant property). This soil is a poorly drained soil with slow permeability and surface runoff. Detour soils are poorly suited to farming because of wetness. Onsite, Detour soils are generally forested, although there is also substantial acreage where former pasture land is converting to shrubs and trees.

c. EdB - Eastport sand, 0-6% slope comprises 4.0 acres (<1% of the plant property). This is a soil of beach ridges and low dunes on the plant site. This soil is found about a quarter-mile inland in a narrow band associated with the steeply sloped Emmet-Onaway soils. These soils are sparsely wooded and are prone to wind erosion.

d. EoF – Emmet-Onaway sandy loam, 25-50% slopes, comprise 17.3 acres (3.0% of the plant property).

e. Hs - Hessel cobbly loam make up 104.8 acres (18.5% of the plant property). Hessel soils are poorly drained soils formed on lake plains and lake terraces. Water availability is high, organic matter and natural fertility is high. They are, however, poorly suited to woodland, even though this type is predominantly wooded onsite.

[1]Acreage and percentage of onsite soils are based on the original plant property of 570 acres.

f. Lb - Lake beach comprises 26.5 acres (4.7% of the plant property). These narrow strips of lake beach frontage are comprised primarily of sand, although the sand is covered by substantial cobble and boulders. These beaches are subject to storm action and may vary significantly in size depending on Lake Michigan level. Lake beaches harbor unique assemblages of plants adapted to the beaches' ephemeral habitats.

g. Rc - Roscommon sand 0-9% slopes comprises 1.2 acres (<1% of the plant property). This is a poorly-drained soil with high organic matter but low natural fertility. This wetland soil occurs along Susan Creek on the far eastern perimeter of the plant property.

3.2.2.2 Flora

The land cover map for Hayes Township, Charlevoix County, shown in Figure 3.2-5, was obtained from the Michigan Department of Natural Resources (MDNR), Land and Water Management Division.

Nomenclature follows the Michigan Land Cover Use Classification System [Reference 3.2-17]. The first three digits of this system describe forest type for forested areas; the last two digits refer to tree species and stocking density (in all cases a zero denotes undifferentiated land cover types). Table 3.2-5 lists cover types and their acreage within the Big Rock Point property boundary including tree species (where available) and stocking density. While helpful in depicting general forest cover on the Big Rock Point property, this map is based on 1978 color aerial photos. Since that date, dramatic successional changes have occurred. Open areas have succeeded to young stands of cedar and birch. Growth that was formerly dominated by sawtimber-sized aspen and birch is now dominated by pole-sized white cedar and balsam fir due to death of the senescent aspen and birch and release of the coniferous understory. In general, the Big Rock Point site forest vegetation is now typically characterized as lowland conifer, pole-sized and well-stocked (cover Type 42306). Figure 3.2-5 and Table 3.2-5 cover types are based on 1978 coverage provided by the MDNR. Each land cover or use type is discussed below[2].

a. Type 146 - Utilities

The Big Rock Point plant industrial area occupies 15.8 acres or about 2.8% of the plant property.

b. Type 31 - Openland

Herbaceous openland comprises 35.0 acres or 6.2% of the property. This is primarily old grazing or hayland that is reverting to shrubs and trees. Today, much of this type would be classified as 32, shrubland, or a young forest type.

c. Type 32 - Shrubland

A total of 6.8 acres or 1.2% is classified as shrubland. As noted above, this type represents hay or grazing lands that are reverting to a forested condition.

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[2]Acreage and percentage of onsite vegetation are based on the original plant property of 570 acres.

d. Type 411 - Northern hardwoods

A total of 28.0 acres or 4.9% of the property is in northern hardwoods such as sugar maple (*Acer saccharum*), beech (*Fagus grandifolia*) and white ash (*Fraxinus americana*). The majority of the acreage is of saw-timber size. The shrub and floral understories in these stands are well developed and diverse.

e. Type 413 - Aspen/White Birch

A total of 96.5 acres or 17% of property is classified as aspen/white birch. These stands are located on the better-drained soils. At pole-size, the shrub and floral understories in these stands are moderately well developed. Conifer understories are well developed on wetter areas.

f. Type 414 - Lowland Hardwoods (Aspen)

Lowland aspen comprises 233.0 acres or 41% of the plant property. Approximately 58% of this aspen was pole-sized and 42% was saw-timber size in 1978. Floral elements and a conifer understory area were well developed in these stands. Today, these areas have succeeded to lowland conifers of pole size and would generally be typed as 423, lowland conifers.

g. Type 422 - Upland Conifers

Upland conifers comprise 96.6 acres or 17% of the acreage, according to MDNR 1978 cover typing. The current observations indicate these are lowland conifers, Type 423.

h. Type 423 - Lowland Conifers

According to 1978 cover typing, lowland conifers total 49.9 acres or 8.5% of the property. Pole-sized white cedar (*Thuja occidentalis*) is dominant; balsam fir (*Abies balsamea*) and immature white cedar are common in the understory. As noted in the general discussion of site flora, natural succession has converted most of the aspen/birch and lowland hardwood stands to lowland conifers. Type 422, upland conifers, should have originally been designated as Type 423, lowland conifers.

i. Type 72 - Beaches

Beach acreage totals 6.8 acres or about 1.2% of the land base. Beach acreage varies with lake levels, wind direction, and storm accretion and removals. In this dynamic environment, flora must be adapted to changing conditions. Beach grass (*Ammophila breviligulata*), wormwood (*Artemisia spp*), willows (*Salix spp*), white cedar, dogwood (*Cornus spp*), elm (*Ulmus spp*) and other hardy, early successional species move inland or lakeward with the availability of beach. Great Lakes beaches may contain unique floral elements, such as several threatened species which are discussed in Section 3.2.3.

3.2.2.3 Fauna

Birds and mammals in the vicinity of Big Rock Point are generally representative of species found along shoreline and inland habitats in northern lower Michigan. Species diversity, particularly of "nongame" species, may be higher onsite in the more mature habitats than they are regionally. However, species favoring younger successional stages, including uneven-aged aspen stands, such as whitetail deer, snowshoe hare or ruffed grouse may not be as abundant near the plant as they are regionally.

Employee observations indicate that deer, grouse, and wild turkey are present onsite, and rarer animals such as black bear (*Ursus americanas*) or bobcat (*Lynx rufus*) may be present from time to time. Coyotes (*Canis latrans*) appear to be common, as are two of their common prey, snowshoe hare (*Lepus americanus*) and cottontail rabbit (*Sylvilagus floridanus*). Both beaver (*Castor canadensis*) and muskrat (*Ondatra zibethicus*) are common along Susan Creek. A list of wildlife observed near Big Rock Point, compiled by Big Rock Point Environmental Enhancement Team, is contained in Table 3.2-6.

3.2.3 Threatened and Endangered Species

The Big Rock Point site is located in a milieu of relatively undisturbed natural habitats on the shore of Lake Michigan, where there is some probability of encountering threatened or endangered species listed by either the Federal Government or the State of Michigan. Great Lake beaches, both sandy beaches and rock beaches, have the potential for harboring Federally-listed threatened species such as Dwarf lake iris (*Iris lacustris*), Houghton's goldenrod (*Solidago houghtonii*), and Pitcher's thistle (*Cirsium pitcheri*). These species are well-represented in shoreline habitats in Charlevoix County and adjacent counties, as evidenced by Michigan Natural Features Inventory (MNFI) records [Reference 3.2-18]. Through initial surveys Consumers Energy Company has identified the presence of Pitcher's thistle and a State-listed threatened species, the Lake Huron tansy (*Tanacetum huronense*) on beach areas west of the developed plant industrial area. No impact to these species is anticipated, since they are not present in locations expected to be impacted by decommissioning activities. Prior to initiation of any decommissioning activities that could potentially affect endangered shoreline species, additional surveys are conducted using up-to-date listings to identify specifically the existence of endangered species near areas likely to be impacted by these activities.

Inland, conifer swamp and upland habitats could possibly harbor plant or animal species that are State-listed as threatened or of special concern. However, no such species have been specifically identified and none of these inland areas are expected to be disturbed by decommissioning activities.

3.3 METEOROLOGY

The following assessment of the climatology of the plant is based on observations supplied from on-site instrumentation and those made by three National Weather Service (NWS) cooperative stations in the vicinity of Big Rock Point: Charlevoix, 5.2 miles west-southwest; Petoskey, 10.3 miles east; and East Jordan, 14.8 miles south of Big Rock Point. Both Petoskey and East Jordan measure daily maximum and minimum temperatures, precipitation, snowfall and snow depth. Charlevoix measures precipitation, snowfall and snow depth, but not temperature. Onsite instrumentation provides wind direction, wind speed and atmospheric stability.

3.3.1 Regional Climate

Big Rock Point is located on the northeast shore of Lake Michigan, just west of the entrance to Little Traverse Bay. Due to its proximity, the influence of the lake on the climatology at the plant is significant throughout most of the year. In general, the lake has a moderating effect on the weather. Prevailing westerly winds bring cooler spring and early summer temperatures while fall and early winter temperatures are milder than those experienced further inland. As such, the climate at Big Rock Point varies from quasi-marine to continental with the changing of the seasons. Furthermore, since the day-to-day weather is controlled mostly by the passages of synoptic scale high and low pressure areas and fronts, the area near Big Rock Point usually does not experience prolonged periods of hot, humid weather in summer, or extreme cold in the winter [Reference 3.3-1].

3.3.2 Temperature

The normal monthly maximum and minimum temperatures, and their respective extremes, are shown in Figure 3.3-1 [Reference 3.3-2]. These values are taken from the nearby Petoskey station, which has a shoreline exposure very similar to Big Rock Point. On the average, the warmest normal maximum and normal minimum temperatures both occur in July (76.6 °F and 57.0 °F). The coldest normal maximum temperatures usually occur in January (26.7 °F). However, the coldest normal minimum temperatures (12.8 °F) occur in February. By February, northern Lake Michigan is usually frozen over. Thus, its moderating effects on cold temperature and cloud coverage are minimized.

The moderating effect of the lake can be seen in Figure 3.3-2. This figure compares the average monthly high and low temperatures from Petoskey, which is located on the shoreline, with East Jordan, which is located further inland. For all months, the diurnal range for the shoreline station is consistently less than that of the inland site. During the spring months, the high temperatures are typically two to five degrees Fahrenheit cooler near the cold lake. Conversely, low temperatures during the autumn months are two to four degrees Fahrenheit warmer at the shoreline.

The monthly average frequencies for days in which temperatures meet or exceed 0 °F, 32 °F and 90 °F are shown in Figure 3.3-3. Minimum temperatures at or below freezing occur about 150 days each year and reach their peak during January.

Periods of extremely cold weather also occur at Big Rock Point. Temperatures as low as –25 °F shoreline and –41 °F inland have been recorded. Temperatures at or below 0 °F can be expected at the plant eleven days each year.

3.3.3 Precipitation

The normal monthly precipitation received on the Big Rock Point site is shown in Figure 3.3-4. February receives the least precipitation (1.43 inches) while September receives the most (3.83 inches). Overall, the precipitation is very evenly distributed, averaging between two and three inches eight months of the year. Annually, Big Rock Point site receives an average of 31.7 inches of precipitation.

The average number of days with precipitation at or above 0.01", 0.10" and 0.50" is shown in Figure 3.3-5. Due primarily to frequent lake effect snows, January and December have the highest number of 0.01" or greater days (18). July has the lowest number of days (8). During a typical year 149 days receive measurable precipitation. Heavier daily amounts of precipitation, those at and above 0.10" and 0.50", occur mainly during the spring, late summer and fall. These amounts are partially the result of the thunderstorm season, which lasts from March to November.

Occasionally, heavy precipitation falls at Big Rock Point site. Figure 3.3-6 shows the greatest daily amounts observed at the three stations surrounding the plant. Amounts in excess of two inches per day have occurred in every month from May through November. The greatest recorded daily amount is 4.13 inches at Charlevoix during July 1975.

3.3.4 Evaporation

The closest station at which evaporation measurements are recorded is at Lake City, Michigan, approximately 70 miles south of the Big Rock Point. Average monthly precipitation is given in Figure 3.3-7 [Reference 3.3-3]. July, the warmest month, has the highest evaporation rate. Total evaporation for the May through October seasonal averages about 28.0 inches. However, the normal precipitation during this period is only 18.5 inches. Thus, moisture replenishment during the fall and winter months plays a significant role in the success of agriculture and forestry in the general area.

3.3.5 Snowfall

The average monthly snowfalls for Big Rock Point site are shown in Figure 3.3-8. January receives the most with an average of 33.4 inches. Annually, Big Rock Point site averages over 106 inches of snow; however, this has varied greatly over the years, ranging from as little as 43.3 inches in 1954 to as much as 231.0 inches in 1985.

The daily snowfalls at Big Rock Point site are generally the result of light, but frequent, lake-effect squalls. Figure 3.3-9 shows the average frequencies of 0.1", 3" or 6" or greater snowfalls for each month. January ranks first in all three categories with 17, 0.1" days; four, 3" days and one, 6" day. Annually, 56 days receive measurable snow, thirteen days receive three inches or more, and three days receive six inches or more.

Major snowstorms do occasionally occur at Big Rock Point. The maximum daily snowfall recorded in the vicinity of the plant was 20.5 inches in November, 1950.

3.3.6 Snow Depth

Big Rock Point's winter combination of below freezing temperatures and frequent snowfalls is ideal for snow accumulation. The average monthly snow depths at the plant are shown in Figure 3.3-10. February has the deepest average snow cover, approximately 17 inches.

3.3.7 Wind

Wind data are currently collected by ground-level instrumentation located near the plant Monitoring Station. Historical wind data were collected by instrumentation located on the plant stack, 71.3 meters (233.9 feet) above grade. Due to interference with the stack, historical wind direction values between 56.25 degrees and 191.25 degrees were considered invalid. These directions correspond to air flow from the plant toward Lake Michigan.

A windrose for Big Rock Point, based on 1985-1992 "All Winds" joint frequency data, is given in Figure 3.3-11. This plot gives the wind direction frequency, wind speed category frequency, and average wind speed for 16 compass points. The most frequently occurring direction at Big Rock Point is south-southwest (13%). The highest average wind speeds are associated with the north-northwest and north sectors, at 7.6 m/s (17.0 mph) and 7.4 m/s (16.6 mph), respectively. The lowest speeds, 5.6 m/s (12.5 mph), are associated with NE winds. Calm winds, defined as less than 0.4 m/s, are observed only 0.26% of the time.

Monthly average and peak hourly windspeeds (1985-1992) are shown in Figure 3.3-12. In general, the highest windspeeds occur during the December (8.55 m/s, 19.1 mph) and the lowest during July (5.03 m/s, 11.3 mph). The highest hourly windspeed recorded at Big Rock Point was 25.3 m/s (56.6 mph) on February 8, 1986.

The diurnal variation of windspeed at Big Rock Point is noteworthy. Figure 3.3-13 shows the average hourly windspeeds for the four seasons due to the formation of an elevated nocturnal jet. The highest average speeds, measured at the top of the stack, usually occur at night.

3.3.8 Severe Weather

The monthly frequencies for thunderstorms at Big Rock Point are given in Figure 3.3-14 [References 3.3-4, 3.3-5]. June and July have the highest incidence at 7 days each. The normal annual total is 36 days. Most of the storms which arrive at the plant originate over Lake Michigan, where moisture is plentiful. Thus, a significant portion of the 0.10 inches and above and 0.50 inches and above daily precipitation amounts noted in Section 3.3.3 are caused by convective activity.

Tornadic activity in the vicinity of the Big Rock Point is rare. The northern part of Michigan is at the extreme fringe of the midwest tornado belt. During the period from 1930-1985, inclusive, only two tornado sightings have been recorded in Charlevoix County [Reference 3.3-4].

3.4 HYDROLOGY

The data presented in this section describe physical characteristics of the surface and groundwaters within the area immediately surrounding the Big Rock Point.

3.4.1 Surface Waters

Big Rock Point is located on the northeast shore of Lake Michigan in Charlevoix County in the northwestern part of Michigan's Lower Peninsula. Lake Michigan serves as the source of cooling and house service water for the plant.

The water level of Lake Michigan has varied between approximately 576 and 584 feet mean sea level (msl). Lake Michigan water level experiences long-term, seasonal, and short-term variations. Long-term variations are caused by periods of higher or lower than usual precipitation or evaporation lasting several years and extending over a large part of the Great Lakes watershed. The highest recorded (1905-1986) mean monthly water level on northern Lake Michigan near Big Rock Point was 582.6 feet msl (September 1986). The minimum monthly level of Lake Michigan was elevation 576.4 feet msl (USGS, March 1964). Seasonal variations average one foot between high water in July and low water in February. In some years the range may be as high as two feet. Short-term water level fluctuations have a period of a few hours and have, on rare occasions, produced changes in water level of up to three feet [Reference 3.4-1, 3.4-2]. Big Rock Point is located in an area where surface runoff flows directly into Lake Michigan except for U.S. Highway 31 drainage at the property boundary which flows to Susan Creek. Figure 3.4-1 depicts the general watershed areas for the region near Big Rock Point.

The plant industrial area is equipped with a storm drainage system, consisting of catch basins and corrugated metal pipes emptying into Lake Michigan. The drainage system is necessary to prevent ponding on the site. Drainage from building areas is generally away from the plant toward Lake Michigan. Some runoff from high ground is diverted around the plant to the lake by a ditch and culverts on the south and east sides of the industrial area. Drainage areas are well vegetated and relatively flat.

3.4.2 Groundwater

Groundwater at the site moves north into Lake Michigan from the groundwater divide between Lakes Charlevoix and Michigan. The water table elevation was approximately 580 feet msl at the time of construction. The soil is well drained at the plant site. A shallow saturated zone of groundwater is typically encountered at 3 to 6 feet. Beneath this, a layer of glacial till clay greater than 40 feet thick extends to bedrock. The top of the till clay layer is often wet, and soft to firm. The till becomes dry, compact, and very hard with depth [References 3.4-1, 3.4-2].

3.5 GEOLOGY AND SEISMOLOGY

The description of geology and seismology presented in this section has been obtained from the Big Rock Point (BRP) Updated Final Hazards Summary Report and the 1999 Big Rock Plant Core Borings Report [References 3.4-1, 3.4-2]. Geology and seismology considerations for decommissioning of BRP do not differ significantly from those during operation except that the potential consequences of a seismic event would be significantly reduced for BRP during the decommissioning phase.

3.5.1 Geology

3.5.1.1 Regional Geology

The Big Rock Point site lies within the Great Lakes Section of the Central Lowlands Physiographic Province. The dominant features of this section were caused by glaciation and include lakes, prominent end moraines, outwash plains, closed basins forming swamps or lakes, eskers and drumlins, and vast areas of rolling ground moraine between the end moraines. Because of the direction of advance and retreat of the last glaciation, lower peninsula Michigan has a strong surficial northwest-southeast grain. This is also the principal structural trend in Paleozoic rock.

Bedrock consists of limestones and shales of the Traverse Group of Middle Devonian age (395 million years before present (mybp) to 375 mybp). Three formations of the Traverse Group are exposed in the region: the Petoskey, Charlevoix, and Gravel Point formations. The bedrock immediately beneath the plant is the Gravel Point formation because the Petoskey and Charlevoix have been eroded away. Interbedded with the limestone strata are beds of shale and shaley limestone. Much of the southern shoreline of Little Traverse Bay from Charlevoix to Petoskey is formed by outcrops of the Gravel Point formation.

Big Rock Point is located in the Central Stable Region Tectonic Province. This province is characterized by major domes, basins, and arches which formed during the Paleozoic Era (570 mybp to 240 mybp). The site lies above the northern flank of the Michigan Basin, which is one of the large tectonic structures in the Central Stable Region. Bedrock in the region dips at a low angle to the southeast toward the center of the Michigan Basin. Superimposed on this regional dip in the site region, are gentle undulations caused by the presence of minor synclines and anticlines. These folds strike generally northwest-southeast and plunge to the southeast. The axes of major folds within Paleozoic rocks of the Michigan Basin also have northwest-southeast trends.

Regional jointing in the northern Michigan Basin have four major vertical joint sets: N52 E, N46 W, N89 W, and N1 E. These trends are present in the site region with the northwest set being the most prominent. The joints are usually tight and widely spaced, but locally they have been widened by solutioning. Sinkholes exposed in local quarries appear to be aligned along major joint trends.

The Michigan Basin has been relatively stable for several hundred million years and is therefore relatively undeformed. Faults have been identified in Paleozoic rocks in the basin. However, no major faults are known in the site area. The faults in the basin are believed to be pre-Pennsylvanian (more than 330 mybp). They do not offset Pleistocene (10,000 years to 2 mybp) glacial deposits. Minor faults related to ancient solution collapse features have been observed in local quarries. Faults have been postulated, based on seismic reflection profiling in Lake Michigan. These faults have been evaluated and interpreted to be not capable [Reference 3.5-1].

3.5.1.2 Site Geology

Elevations at the plant property on the south shore of Little Traverse Bay range from about 580 feet mean sea level (MSL) at the lake shore to +700 feet MSL about one mile inland. Elevation at the plant industrial area is +590 feet MSL. From the lake shore to about one mile inland the terrain is a lowland that was once submerged beneath ancestral Lake Michigan.

Topography is characterized by low beach ridges with swampy areas between. From one to five miles inland from the lake elevations range from +700 to +900 feet. This area is a till plain with drumlins that rise forty to sixty feet above it. A drainage divide causes surface water and shallow groundwater to flow north to Little Traverse Bay and south to Lake Charlevoix. It is also the probable recharge area for minor artesian zones in the soil beneath the plant site.

The geology of the site was investigated in several phases. Two exploratory borings were drilled into the top of bedrock in May, 1959, and seven more borings were drilled into rock in February, 1960. In 1979, three borings were drilled to determine the dynamic characteristics of the soil and rock beneath the site. Site geologic characterization has also been studied by D'Appolonia [Reference 3.5-2]. In 1999, 26 borings were drilled to better define geologic and hydrogeologic conditions at the site [Reference 3.4-2]. In general, three geologic units of concern have been identified beneath the Big Rock plant site. These units consist of shallow surface sand and gravel, glacial till, and bedrock.

The Gravel Point limestone beneath the plant consists of brown and gray, broken to massive limestone with clay seams and interbedded shale, claystone and siltstone layers. Between depths of about 130 and 190 feet the limestone contains vuggy zones where core recovery and RQD (Rock Quality Designation) percentages were low.

The bedrock is Traverse limestone and is located from 45 to 55 feet below grade. The top of the bedrock represents an erosional surface with the upper ten feet being highly fractured. This fractured bedrock is directly connected with Lake Michigan and the groundwater gradient responds to short term lake water level variations. The Traverse limestone is overlain by a layer of glacial till clay greater than 40 feet thick. Although the till clay is generally homogeneous, it occasionally exhibits alternating clay and fine silt laminations. The top 3 to 16 feet of soil is comprised of a combination of fill material and native soils consisting of beach sand, clayey sands and gravel.

3.5.2 Seismology

The probability that earthquakes of significant intensity will occur in the general area appears to be very low. As referenced in the Big Rock Point FHSR, the Coast and Geodetic Survey Publication, Serial 609, Earthquake History of the United States, lists earthquakes in the Michigan area as shown below. All of these are classified as intermediate or minor. The nearest recorded earthquake was the one centered near Menominee, approximately 110 miles from the plant.

Earthquake History as of Plant Construction

Date	Locality	Rossi-Forel Intensity
February 6, 1872	Winona, Michigan	5*
August 17, 1877	Southeast Michigan	4-5
February 4, 1883	Indiana and Michigan	6
March 13, 1905	Menominee, Michigan	5
July 26, 1905	Calumet, Michigan	8
May 26, 1906	Keewenaw Peninsula, Michigan	8-9
January 22, 1909	Houghton, Michigan	5*

Locally-felt only

NOTE: Since 1909, no earthquakes centered within a 150-mile radius of Big Rock Point have been documented.

Due to the absence of earthquakes centered near the plant, as identified at the time of plant construction, elaborate or special seismic design features were determined to be unnecessary in the plant's construction. All structures are designed to resist nominal seismic loading based upon conservatively meeting the Uniform Building Code for Zone 1.

The Uniform Building Code does not clearly cover the reactor containment vessel or the concrete structure and equipment within. In view of their high degree of rigidity, a seismic factor was used (for original design of the reactor containment vessel and concrete structure within) equal to the maximum expected ground acceleration of 0.05 g.

3.6 REFERENCES

a. 3.1-1, Emmet County/City of Petoskey Comprehensive Plan, Emmet County Planning Commission, April 1993

b. 3.1-2, Engineering Analysis, EA-RETS-CIP-51, Census 2000 Population Evaluation for Area Surrounding Big Rock Point, June 2001

c. 3.1-3, U.S. Census Bureau, 2000 Census

d. 3.1-4, Charlevoix County Planning Commission, letter dated March 8, 1994

e. 3.1-5, Personal communication with Charlevoix Schools administrative personnel, December 20, 1999; enrollment based on the Fourth-Friday Count as of September 24, 1999

f. 3.1-6, Personal communication with St. Mary's School administrative personnel, December 21, 1999

g. 3.1-7, Clemets, J., "Flying the Colors: Michigan Facts," 1990, page 102

h. 3.1-8, U.S. Department of Agriculture, Charlevoix County ASCS Office, letter dated April 6, 1994

i. 3.1-9, Big Rock Point 1998 Land Use Census, letter from MLGrogan to KEPallagi dated September 28, 1998

j. 3.1-10, Personal communication with Little Traverse Conservancy personnel, March 23, 1994

k. 3.1-11, State Historic Preservation Office, Bureau of Michigan History, letter dated April 5, 1994

l. 3.1-12, Personal communication with Charlevoix County Health Department personnel, March 25, 1994

m. 3.1-13, Chemical Analysis of Water, Bureau of Laboratory and Epidemiological Studies, Michigan Dept of Public Health, May 1988

n. 3.1-14, Final Report, Phase I Archeological Survey, Big Rock Nuclear Power Plant, Hayes Township, Charlevoix, Michigan; ER-940273, March 15, 2001

o. 3.1-15, State Historic Preservation Office letter to Consumers Energy, dated March 7, 2001.

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q. 3.2-2, Big Rock Point Control Room Logs

r. 3.2-3, Comprehensive Monitoring Program, Tip of the Mitt Watershed Council, May 1992

s. 3.2-4, Little Traverse Bay 5-Year Monitoring Report, Tip of the Mitt Watershed Council, 1987

t. 3.2-5, Letter, D.J. Snedeker, Consumers Power Company, to J. Beer, Consumers Power Company, Chemical Test Results of Lake Water and Well Water, February 27, 1992

u. 3.2-6, Field Methodology and Results for Charlevoix Harbor, Charlevoix, Michigan; Limno-Tech, Inc., July 1985

v. 3.2-7, J.H. Campbell Plant Environmental Report, Volume 2, Appendix 3E, Consumers Power Company, 1975

w. 3.2-8, Maintenance Dredging of Unpolluted Harbor Sediments in Michigan, Detroit District Final Environmental Statement, U.S. Army Corp of Engineers, March 1975

x. 3.2-9, Goodyear, C.S., T.A. Edsall, D.M. Ormsby Dempsey, G.D. Moss, and P.E. Polonski, Atlas of the Spawning and Nursery Areas of Great Lakes, Volume 1 - Summary and Volume 4 - Lake Michigan, U.S. Fish and Wildlife Service, Washington, DC, 1982

y. 3.2-10, Lake Michigan Entrainment Studies at the Big Rock Nuclear Plant and Escanaba Power Plant, Grosse Ile Laboratory, 1972

z. 3.2-11, Coshun, M., Lake Michigan Salmon Stocking Program, Wisconsin Department of Natural Resources, 1992

aa. 3.2-12, MDNR Sport Catch Estimates for Lake Michigan, Charlevoix County, 1993 (*unpublished*)

ab. 3.2-13, Lake Michigan Committee, Report of 1989 Annual Meeting, Sault Ste. Marie, Ontario, (Provisional data, prepared by Will Hartman, USFWS), Great Lakes Fishery Commission, 1989

ac. 3.2-14, Fisheries and Management Report, Michigan Waters of Lake Michigan, 1993, Michigan Department of Natural Resources, Fisheries Division, Lake Michigan Fishery Research Station, Charlevoix MI, 1993 ad. 3.2-15, Status of Forage Fish Stocks in Lake Michigan, Department of Interior, National Biological Survey, Great Lakes Center, Ann Arbor, MI, 1993 (Provisional data presented at Lake Michigan Committee meeting, March 23, 1994)

ae. 3.2-16, Soil Survey of Charlevoix County, Michigan, U.S. Department of Agriculture, Soil Conservation Service, May 1974

af. 3.2-17, Michigan Land Cover Use Classification System, Michigan Department of Natural Resources, Land and Water Management Division

ag. 3.2-18, Charlevoix County Element List, Michigan Natural Features Inventory, Michigan Department of Natural Resources, June 1992

ah. 3.3-1, Climate of Michigan by Stations, Michigan Department of Agriculture, Michigan Weather Service, December 1971

ai. 3.3-2, Michigan; Climatography of the United States Number 81; Monthly Station Normals of Temperature, Precipitation, and Heating and Cooling Degree Days, 1961-90; National Oceanic and Atmospheric Administration; National Environmental Satellite Data, and Information Service; National Climatic Data Center, Asheville, North Carolina, January 1992

aj. 3.3-3, Supplements to the Climate of Michigan by Stations, Michigan Department of Agriculture, Michigan Weather Service, 1976

ak. 3.3-4, The Climatic Atlas of Michigan, The University of Notre Dame Press, 1990

al. 3.3-5, Weather Atlas of the United States, United States Environmental Data Service, Department of Commerce, June 1968

am. 3.4-1, Consumers Energy Company, Final Hazards Summary Report (FHSR), Section 2.5

an. 3.4-2, Consumers Energy, Big Rock Plant Core Borings Report, Radian International, August 23, 1999 ao. 3.5-1, U.S. NRC, "SEP Review Topics II-4, Geology and Seismology and II-4.B Proximity of Capable Tectonic Structures in Plant Vicinity", letter dated October 12, 1982

ap. 3.5-2, D'Appolonia Consulting Engineers, Inc., "Project 78-435, Seismic Safety Margin Evaluation", Reports dated December 1980, August 1981 and August 1983

Figure 3.1-1
BIG ROCK POINT NUCLEAR PLANT
SITE BOUNDARY & OWNER-CONTROLLED AREAS

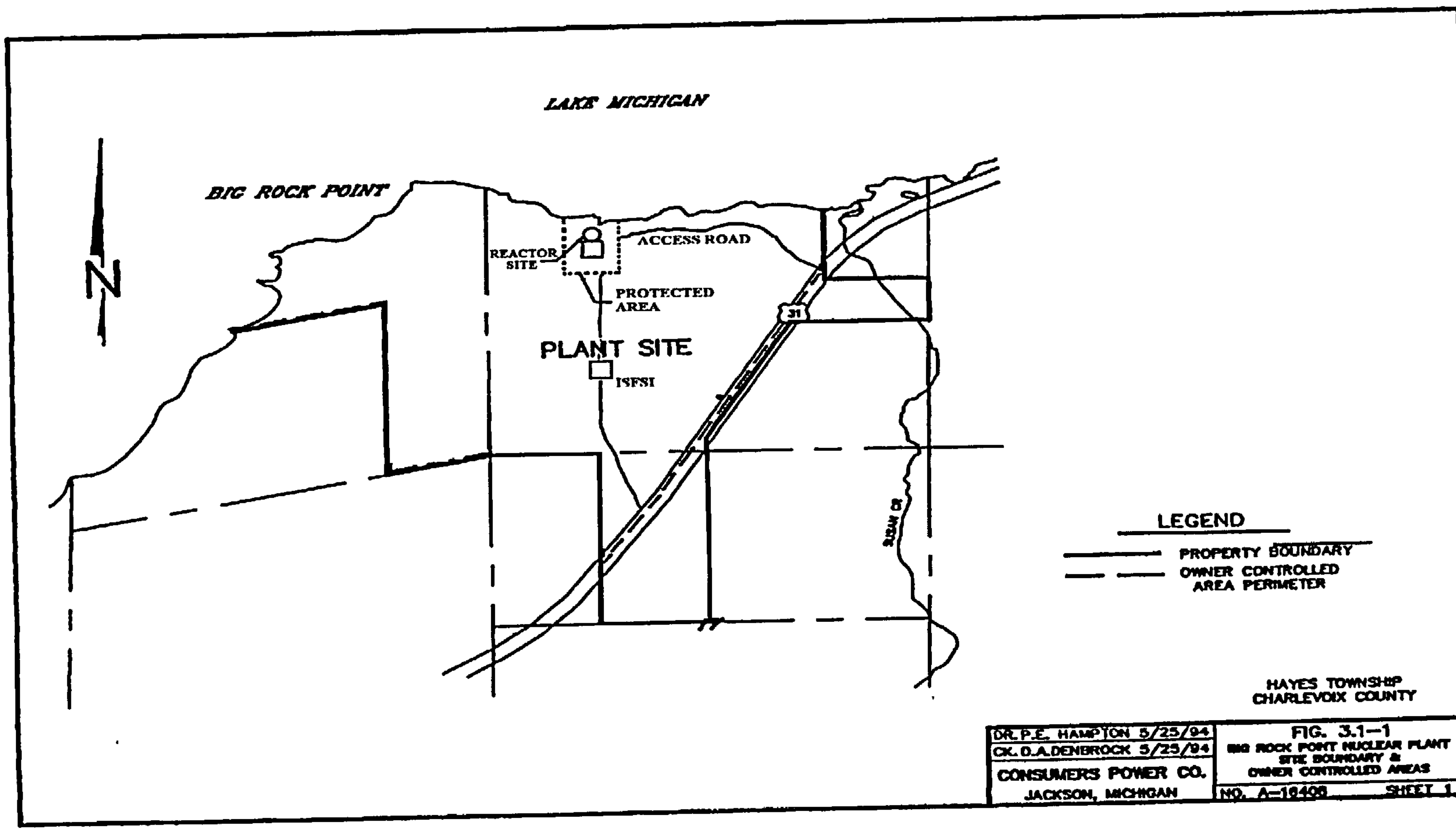


Figure 3.1-2
FACILITIES WITHIN A FIVE-MILE RADIUS OF BIG ROCK POINT

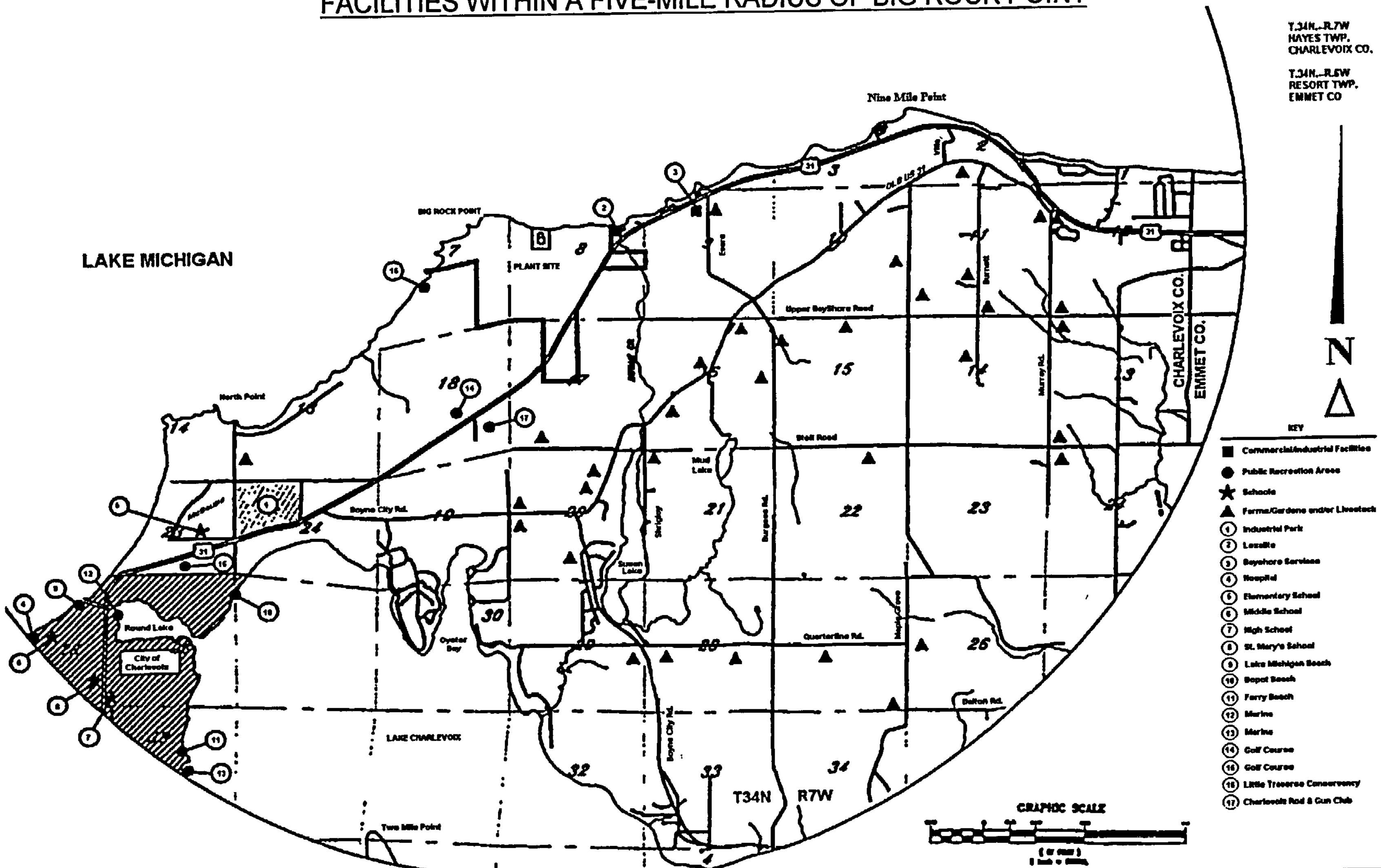


Figure 3.2-1
WATER QUALITY SAMPLING LOCATIONS

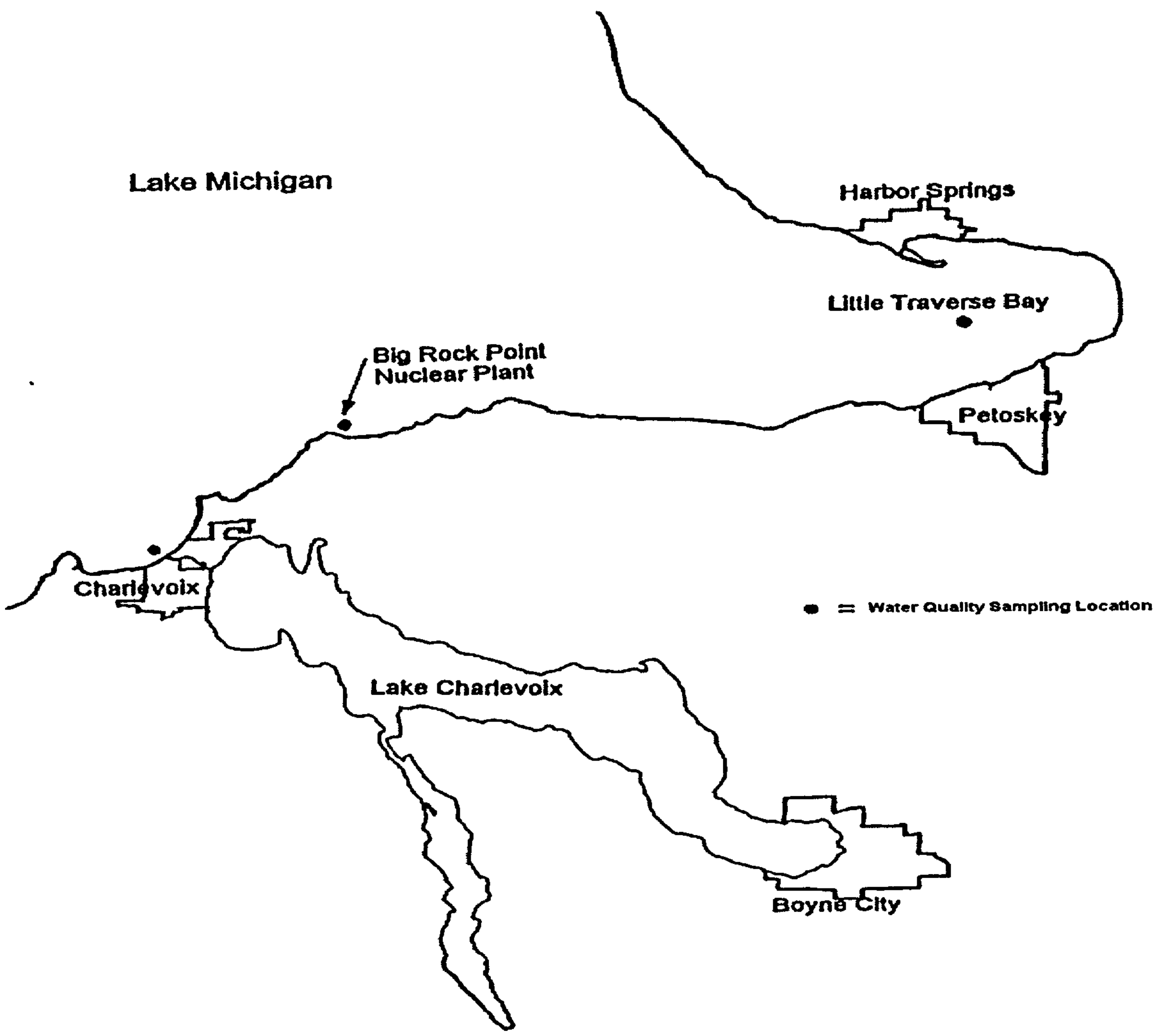


Figure 3.2-2
LAKE MICHIGAN NATIVE AMERICAN TRIBAL FISHING ZONES

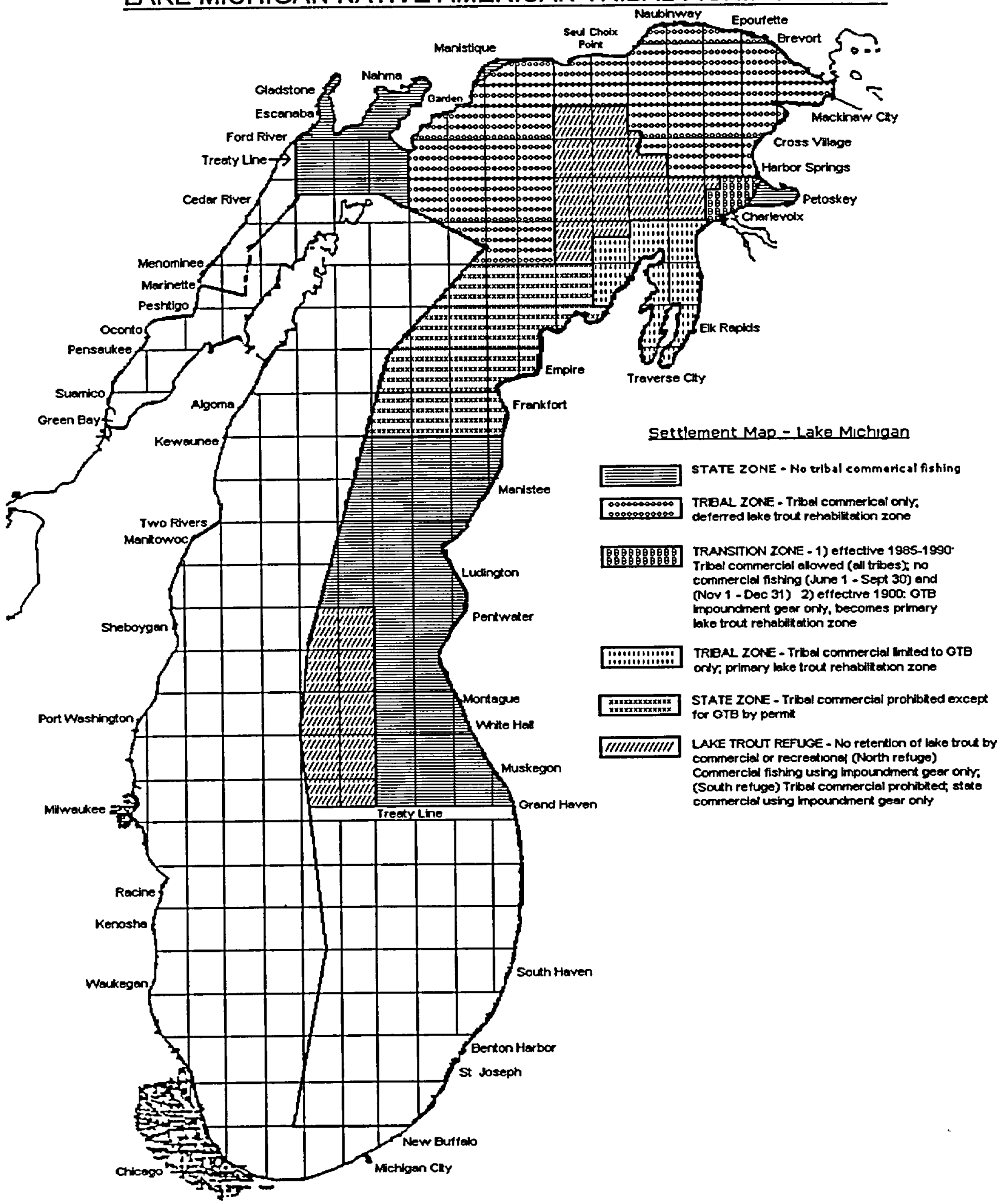


Figure 3.2-3
MEAN NUMBER OF ADULT FISH PER TRAWL TOW
(LAKE MICHIGAN 1973 – 1993)

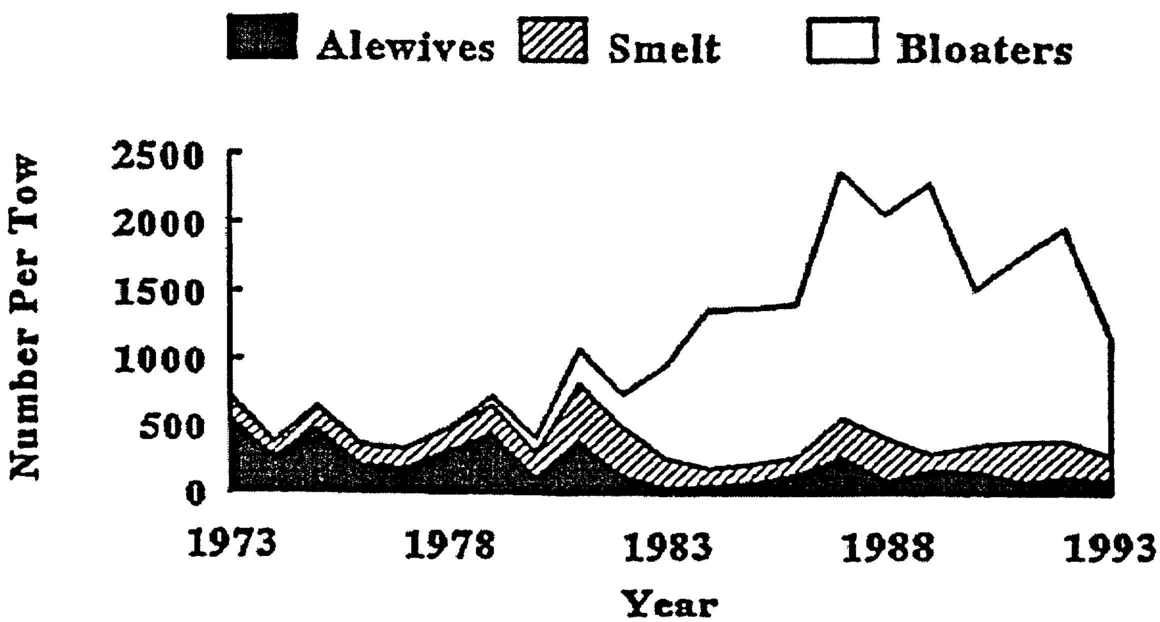


Figure 3.2-4
BIG ROCK POINT SOIL TYPES

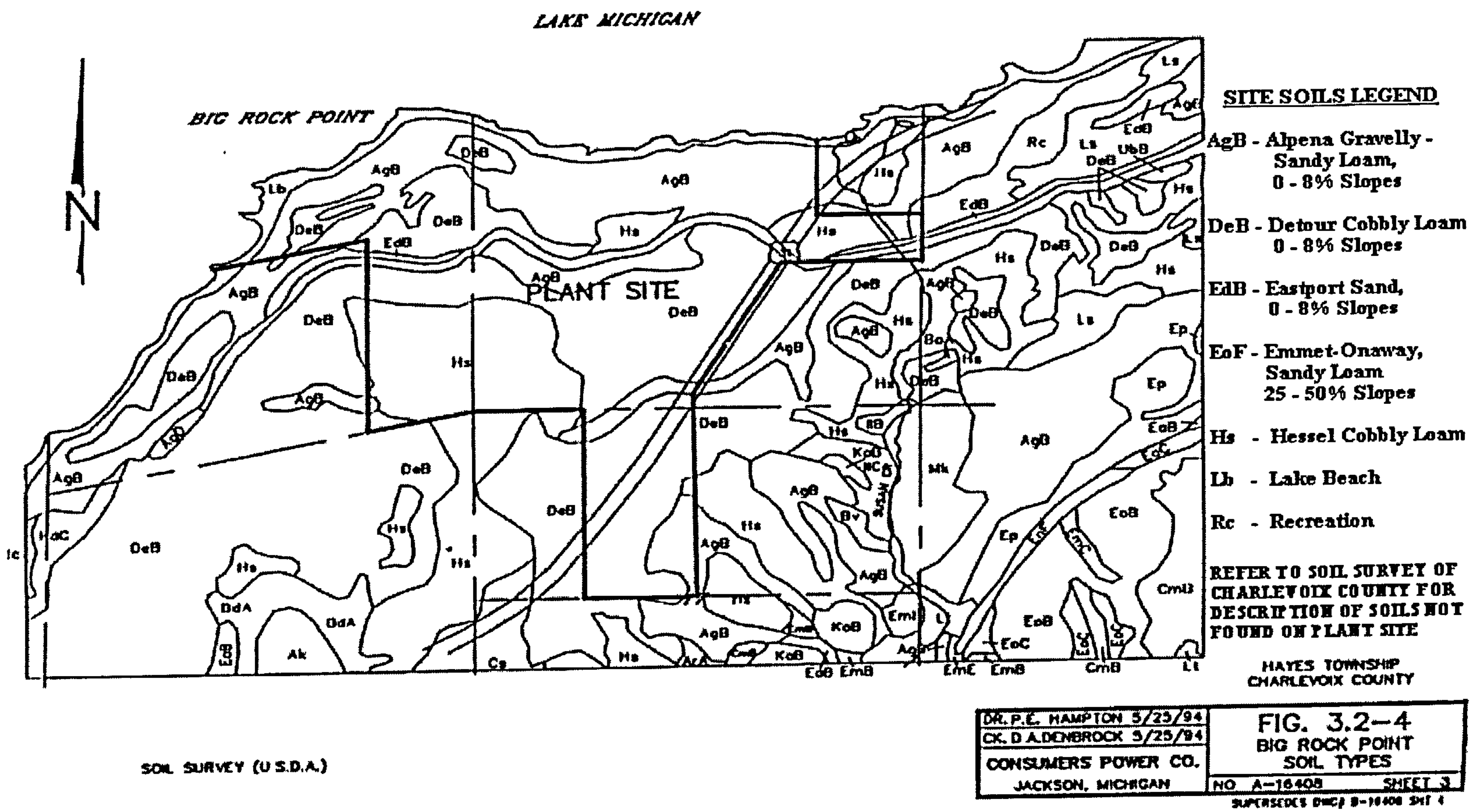


Figure 3.2-5
<u>BIG ROCK POINT LAND COVER</u>

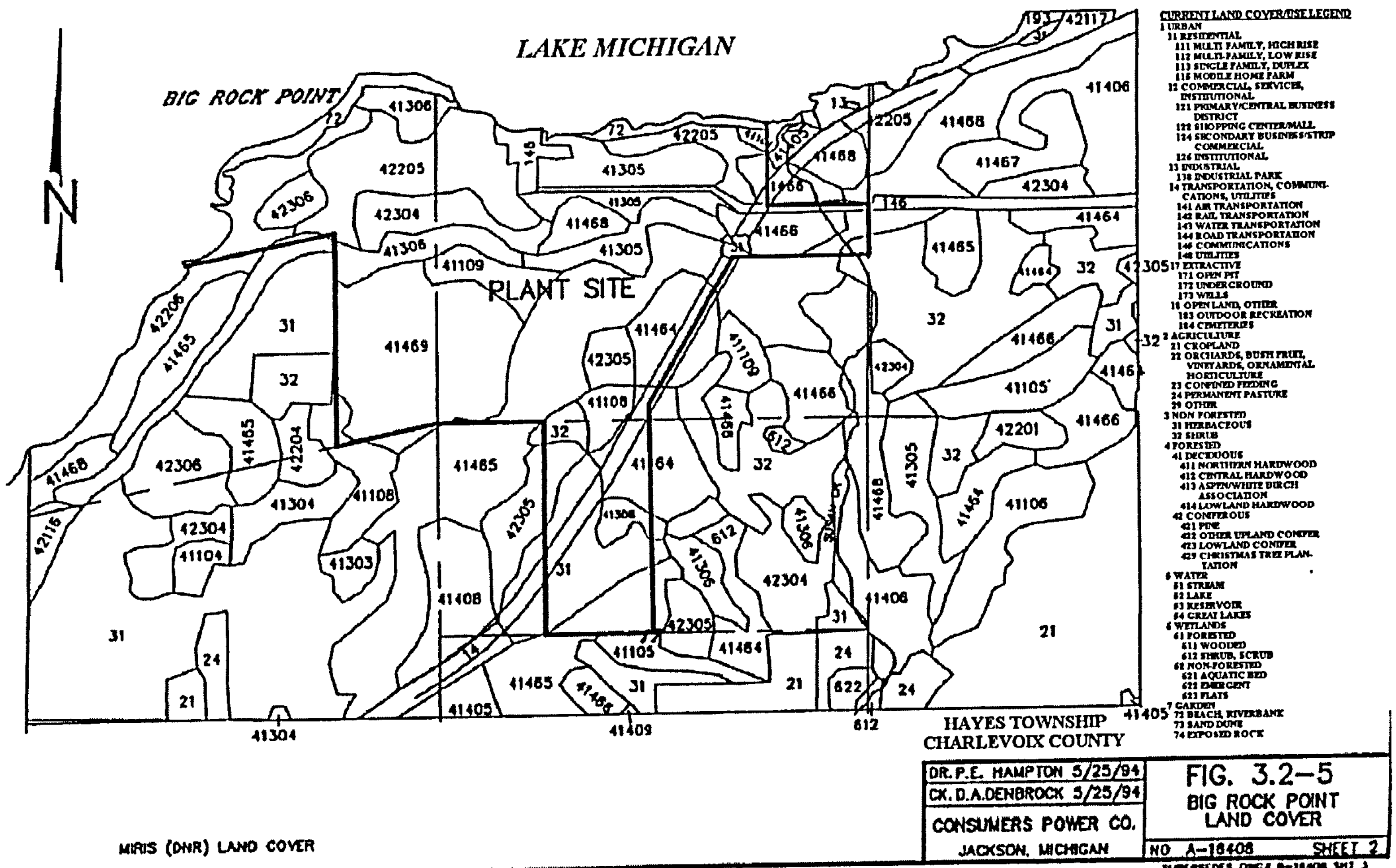
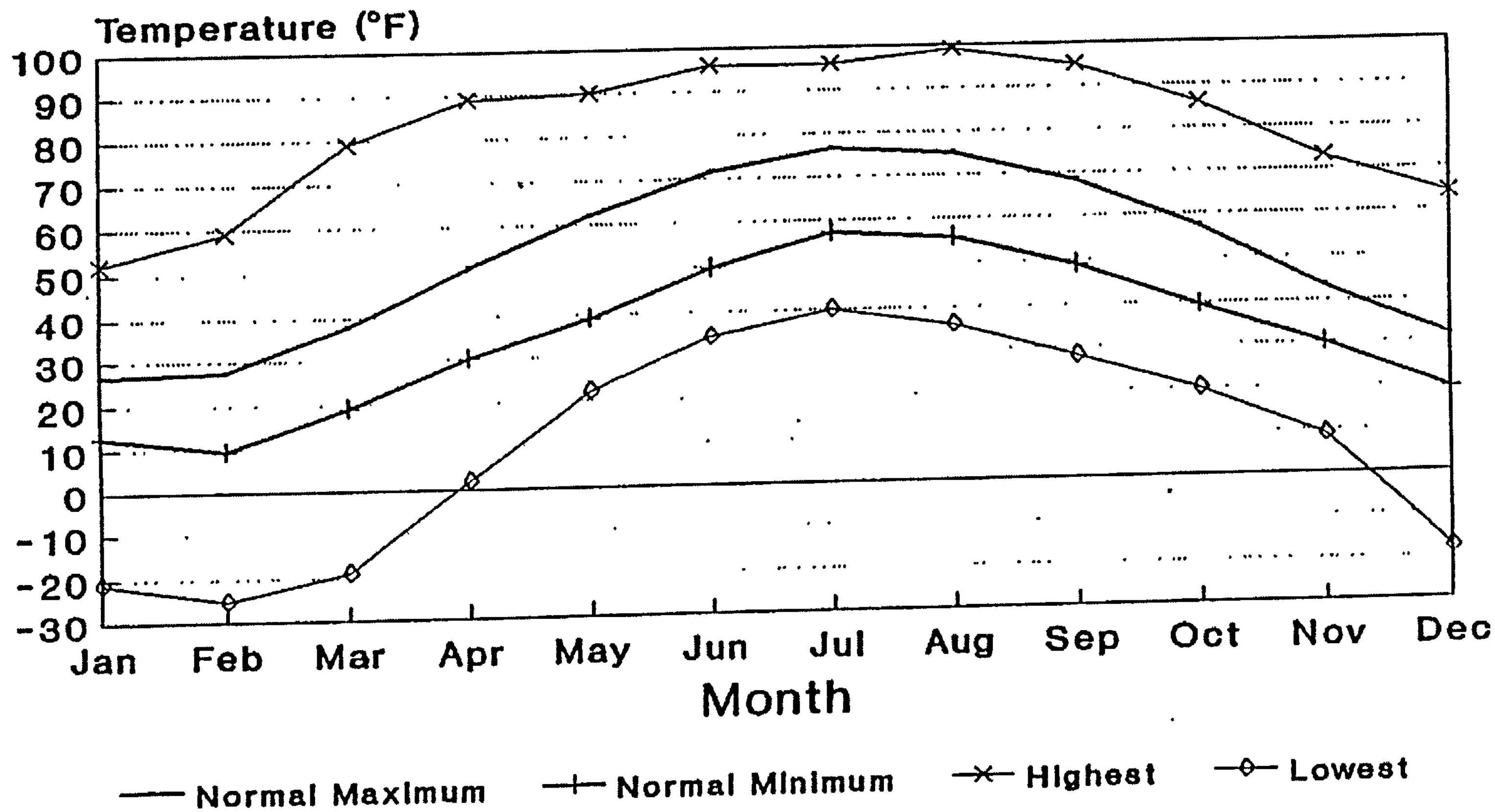
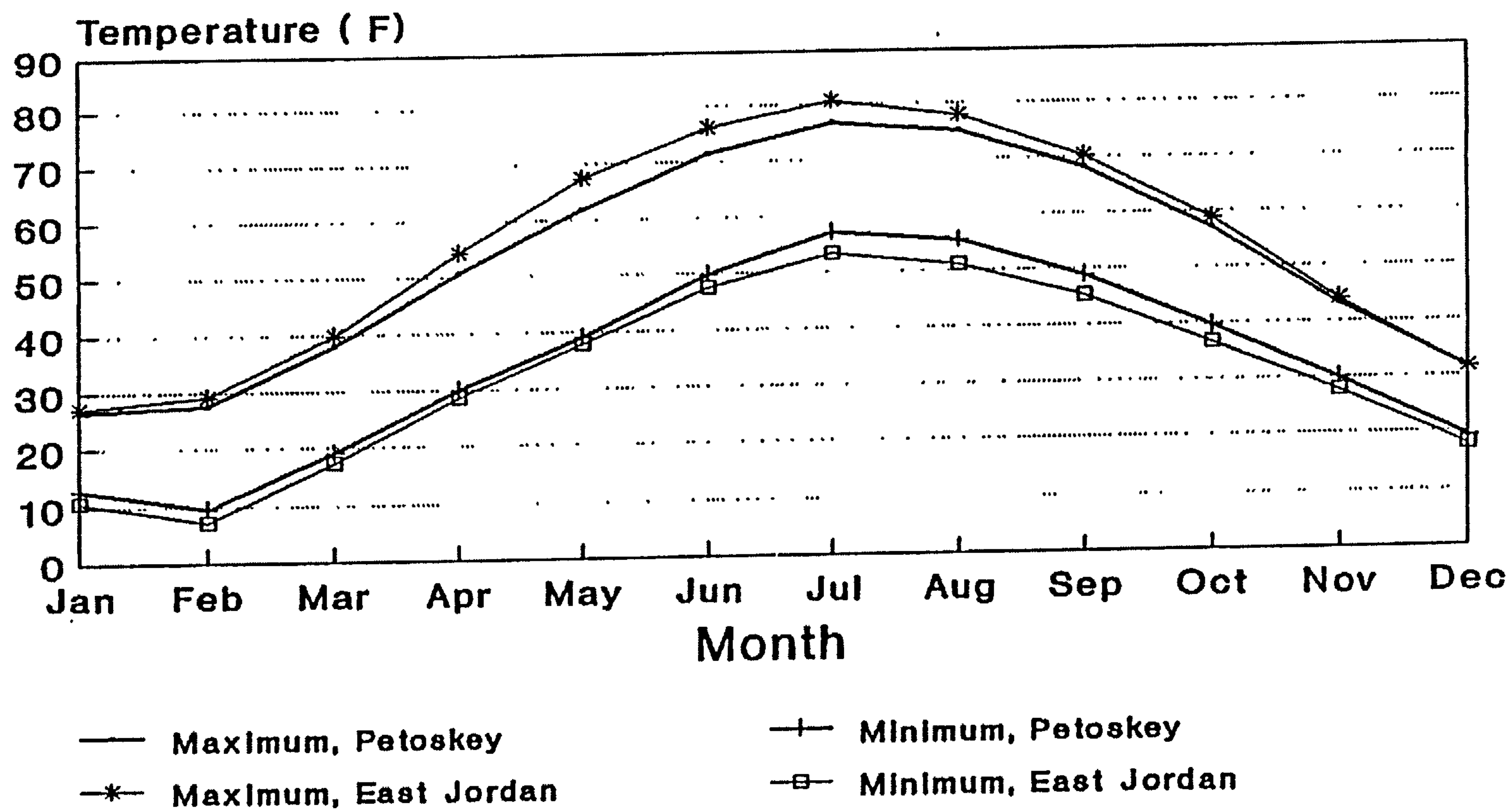


Figure 3.3-1
MONTHLY TEMPERATURES, BIG ROCK POINT



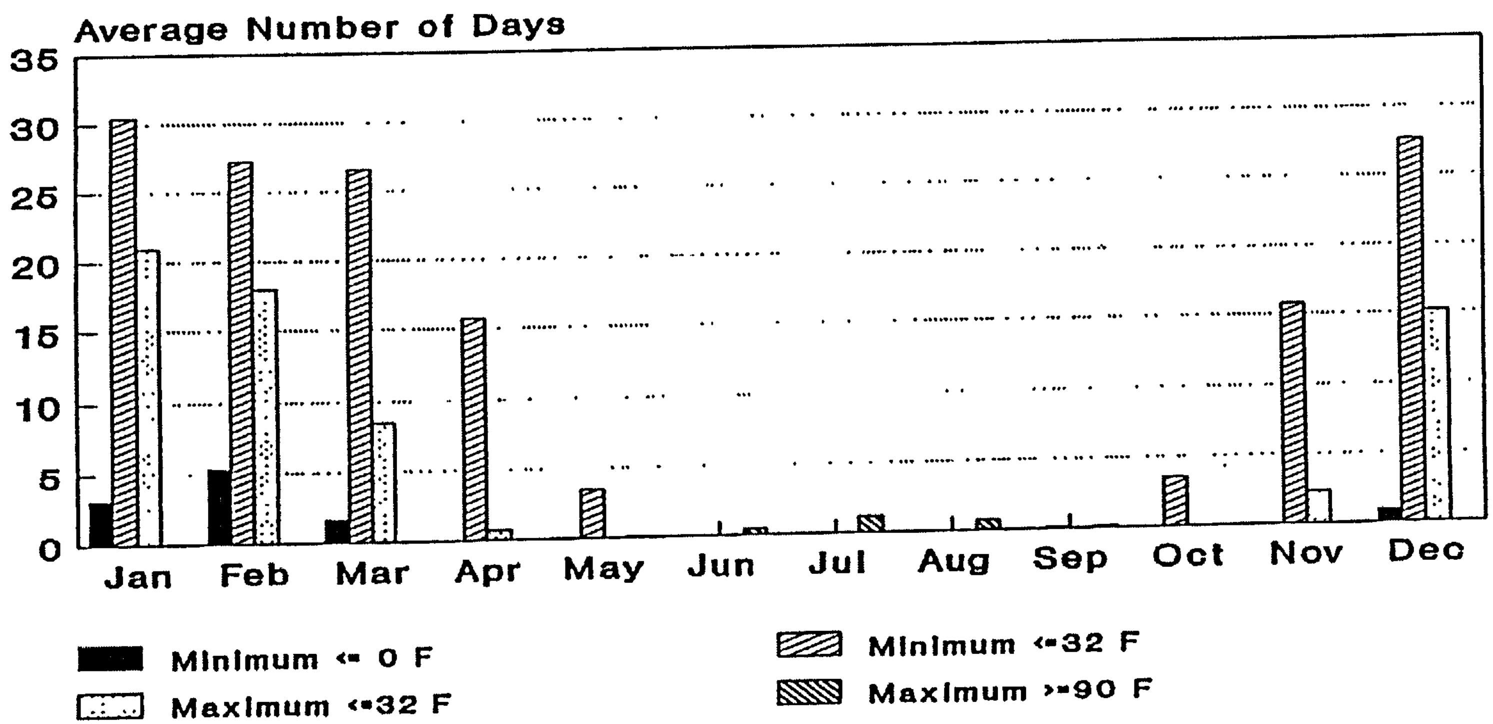
1961-1990 Normals

Figure 3.3-2
NORMAL MONTHLY TEMPERATURES, BIG ROCK POINT



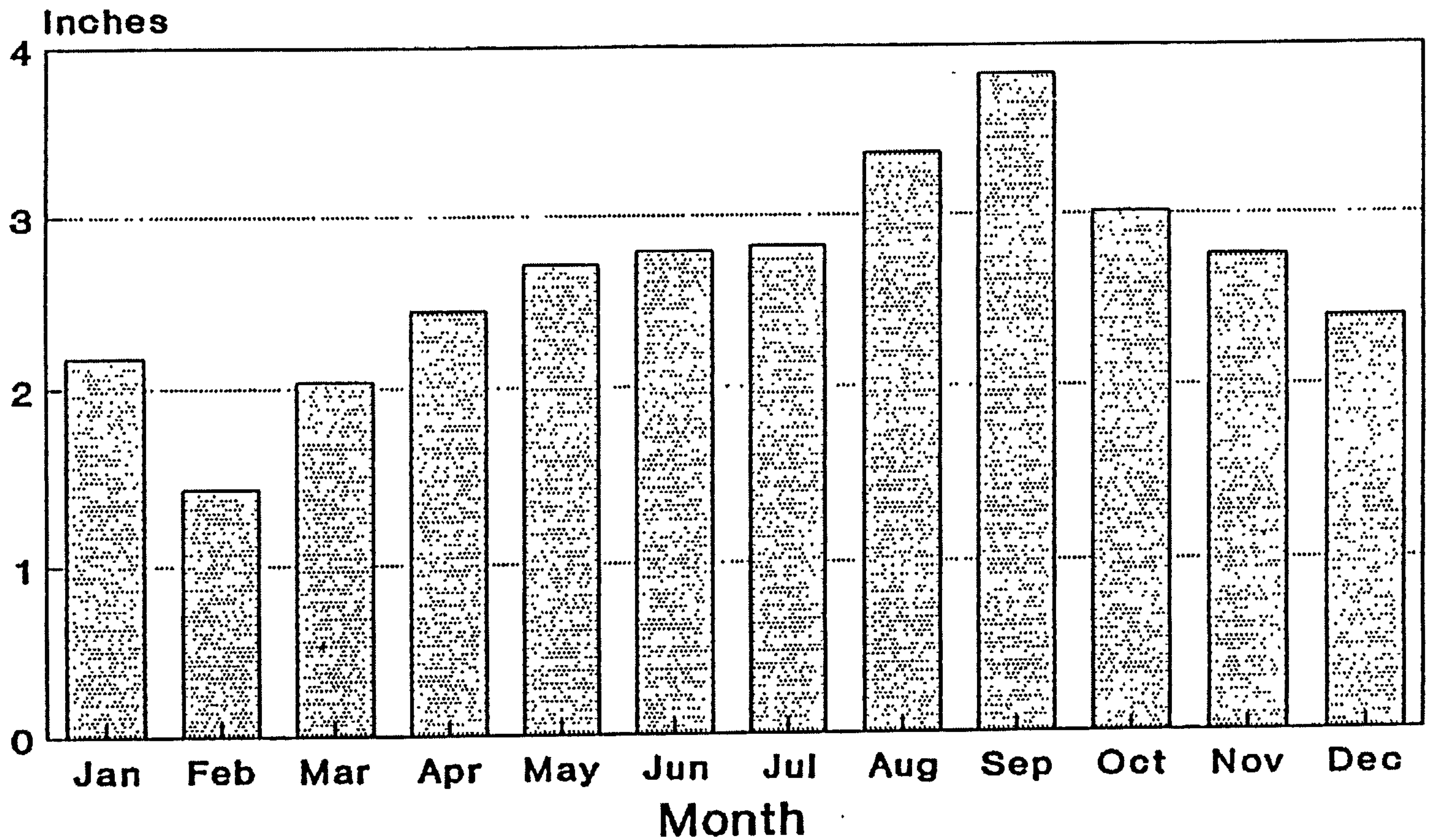
1961-1990 Data

Figure 3.3-3
TEMPERATURE FREQUENCY, BIG ROCK POINT



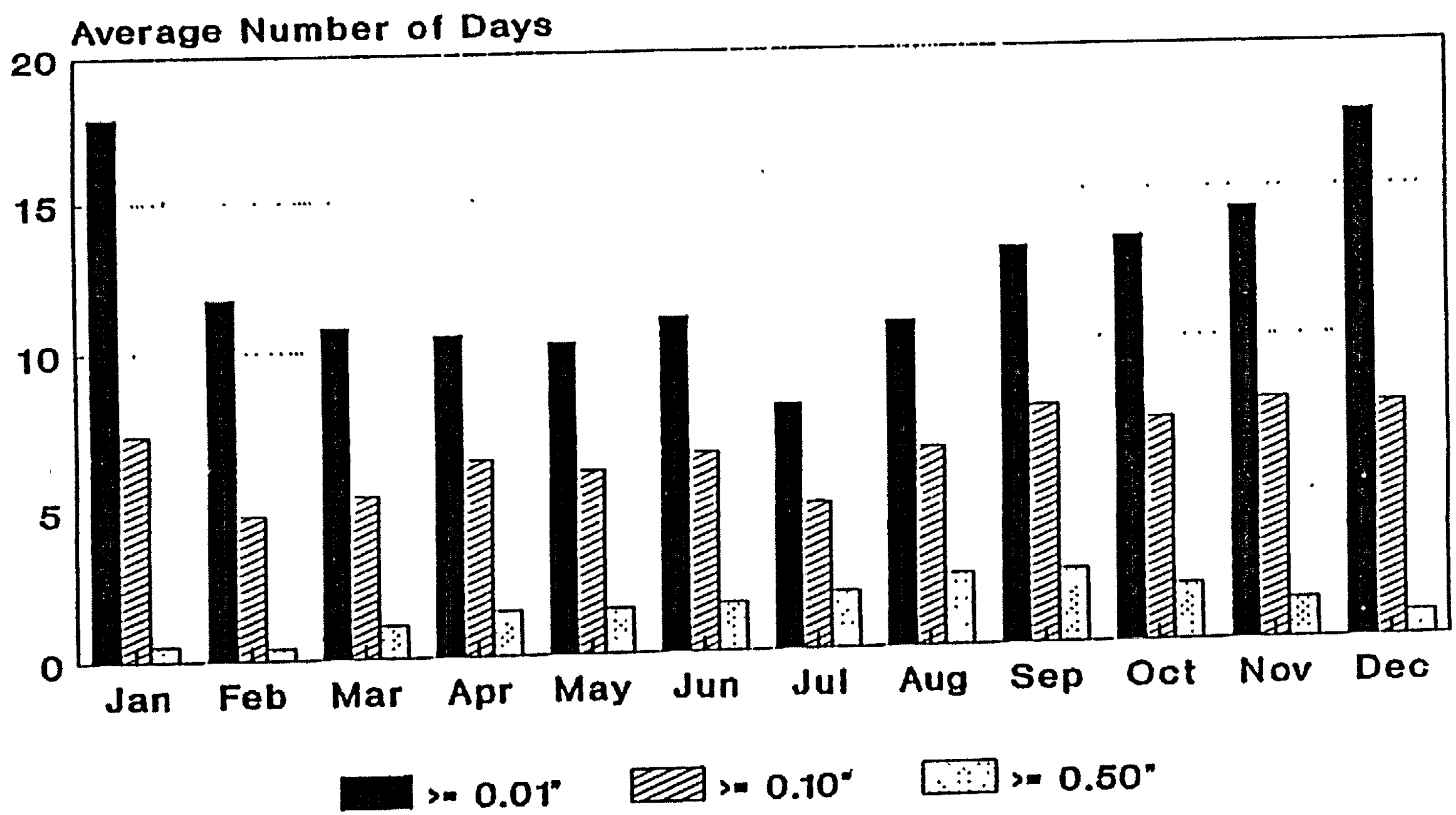
1961-1990 Data

Figure 3.3-4
NORMAL MONTHLY PRECIPITATION, BIG ROCK POINT



1961-1990 Data

Figure 3.3-5
PRECIPITATION AMOUNT FREQUENCY, BIG ROCK POINT



1961-1990 Data

Figure 3.3-6
GREATEST DAILY PRECIPITATION, BIG ROCK POINT

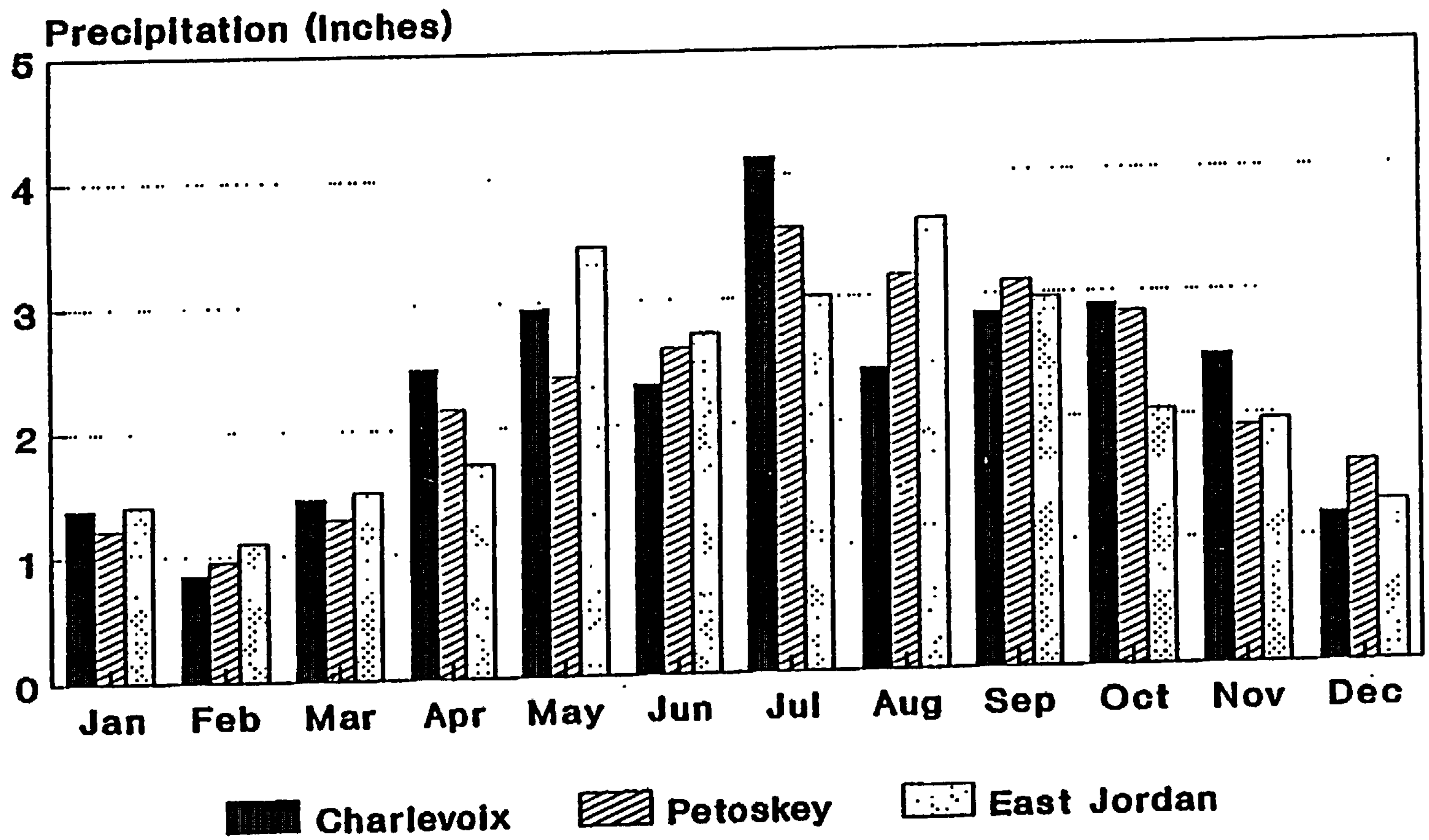


Figure 3.3-7
NORMAL MONTHLY EVAPORATION, BIG ROCK POINT

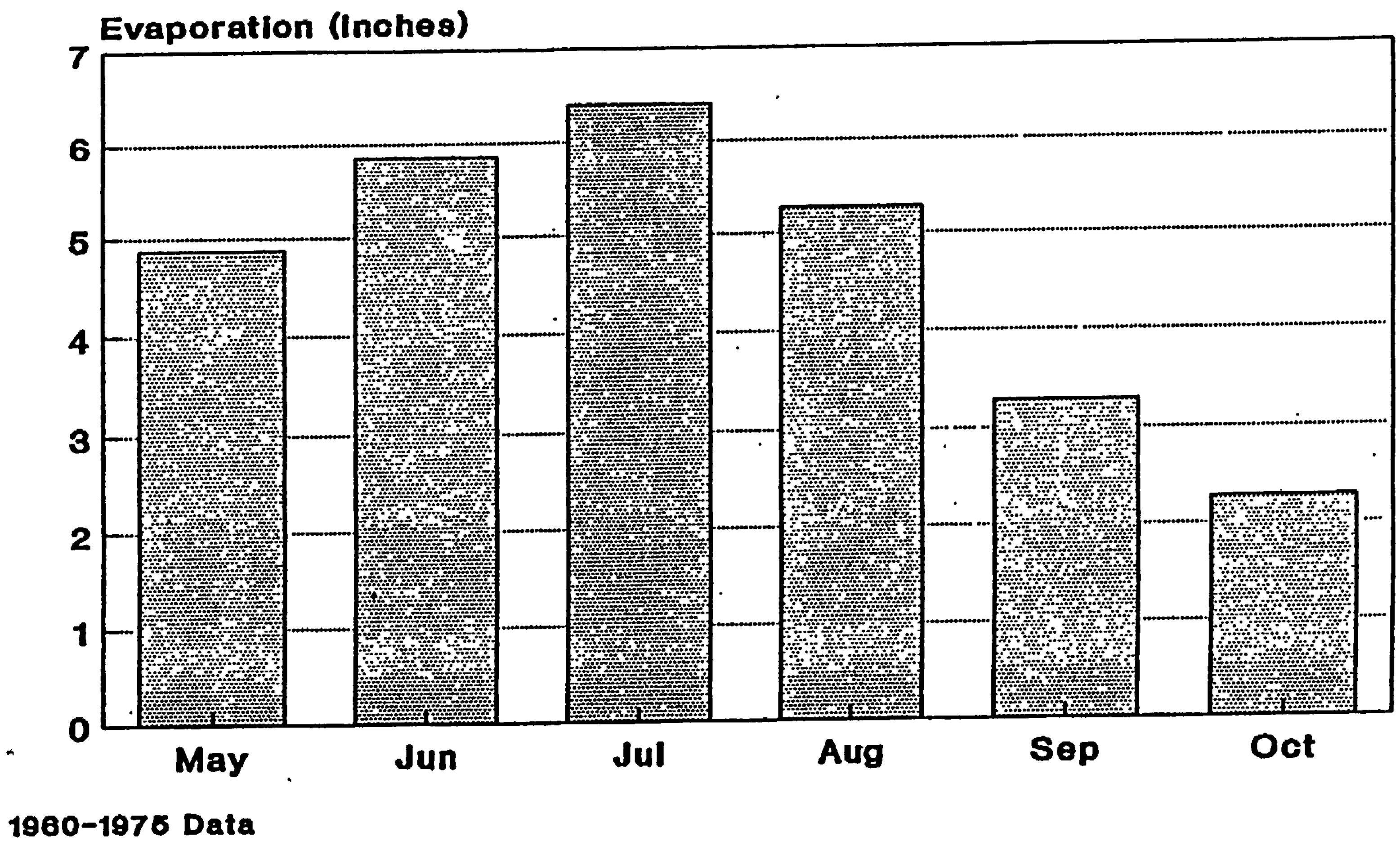


Figure 3.3-8
NORMAL MONTHLY SNOWFALL, BIG ROCK POINT

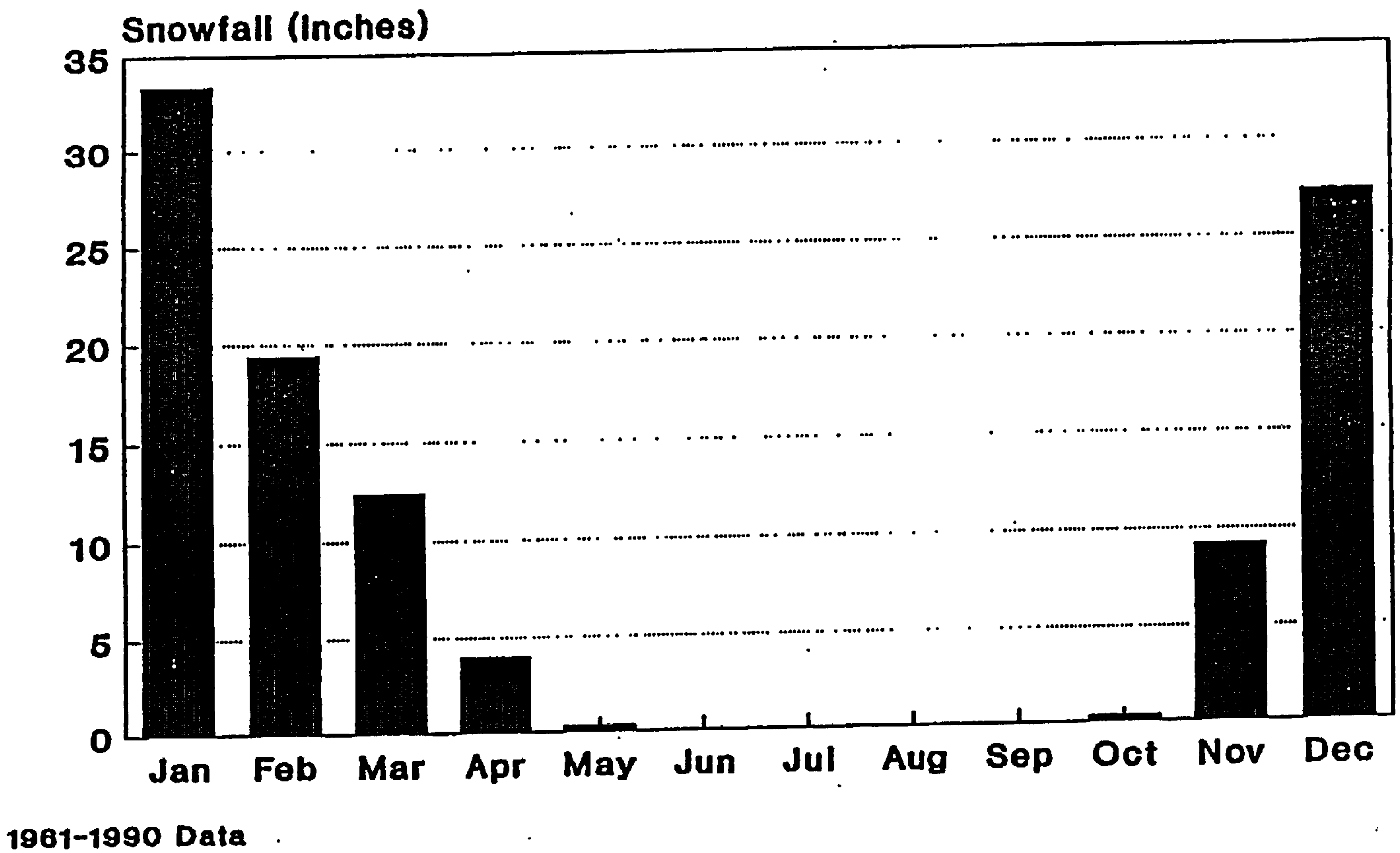
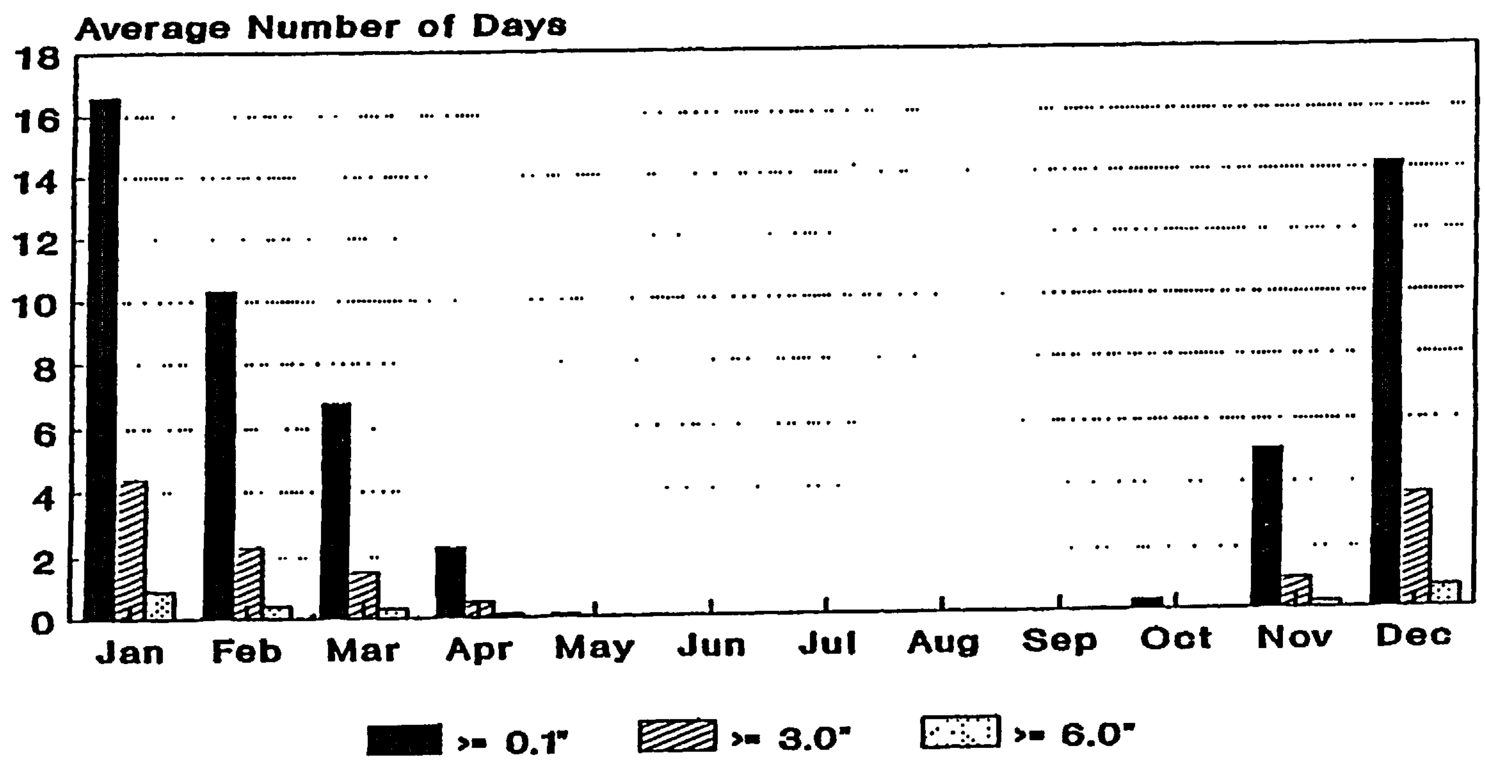


Figure 3.3-9
SNOWFALL AMOUNT FREQUENCY, BIG ROCK POINT



1961-1990 Data

Figure 3.3-10
AVERAGE MONTHLY SNOW DEPTH, BIG ROCK POINT

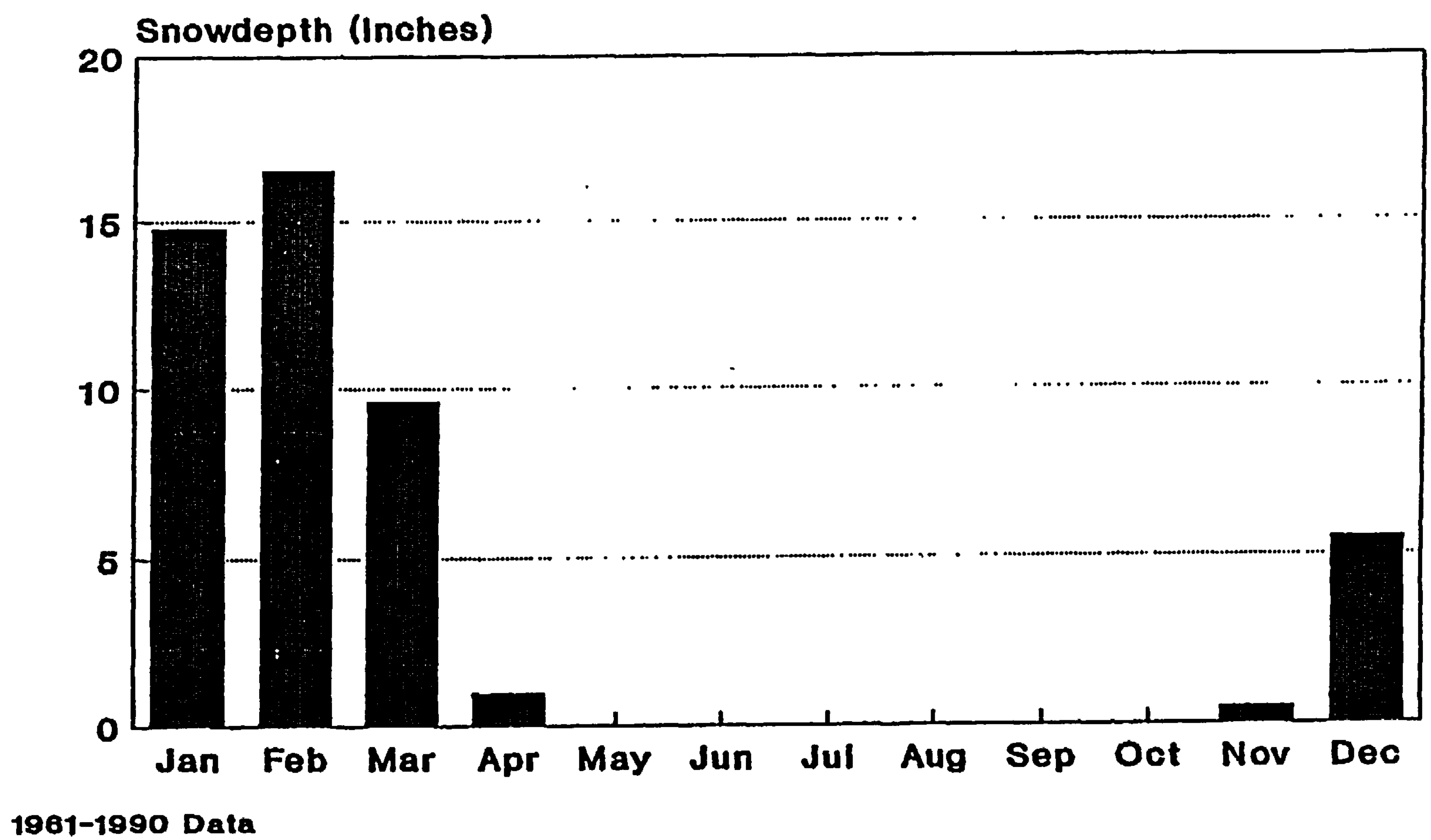


Figure 3.3-11
WIND FREQUENCY DISTRIBUTION, BIG ROCK POINT

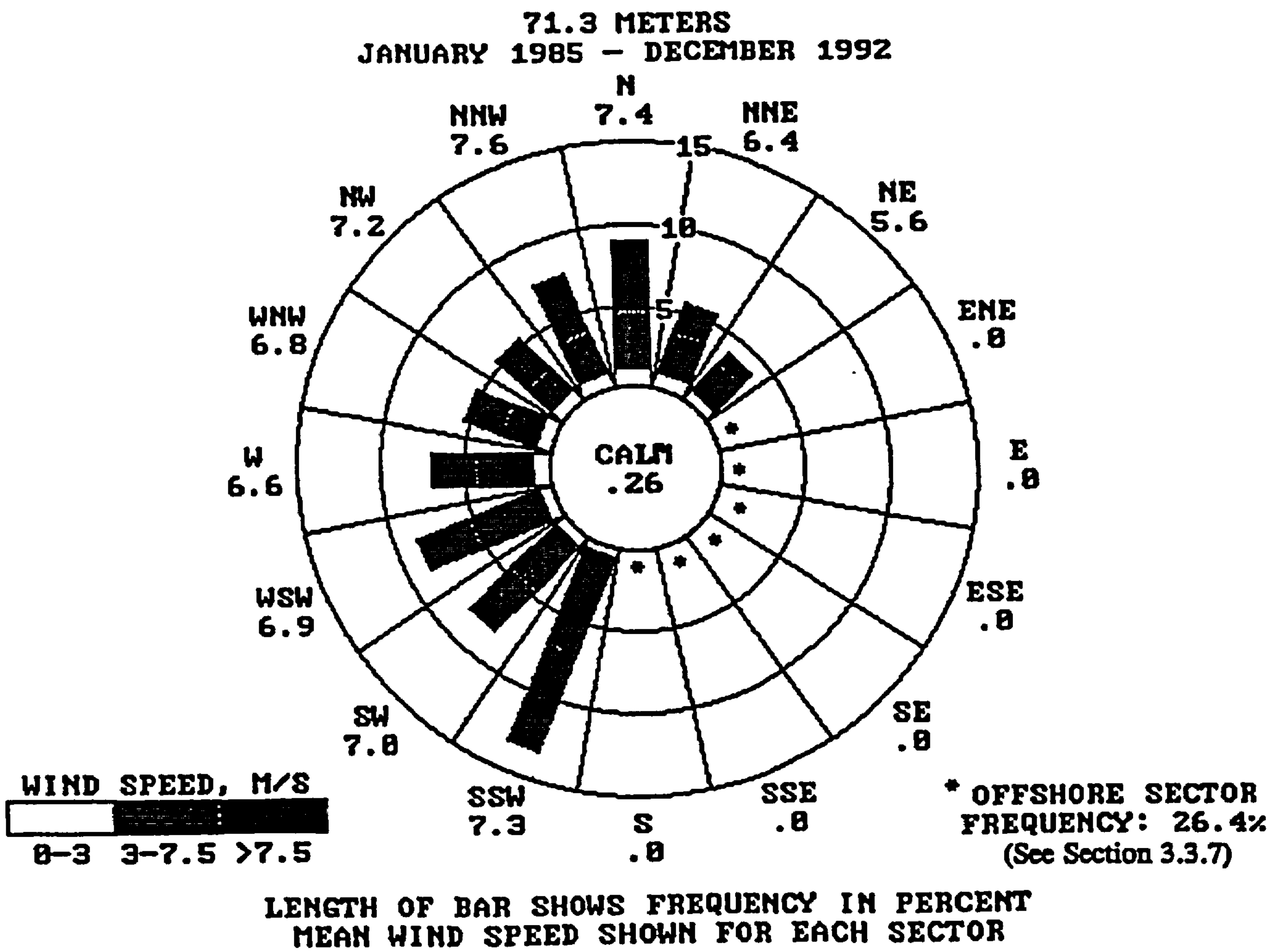
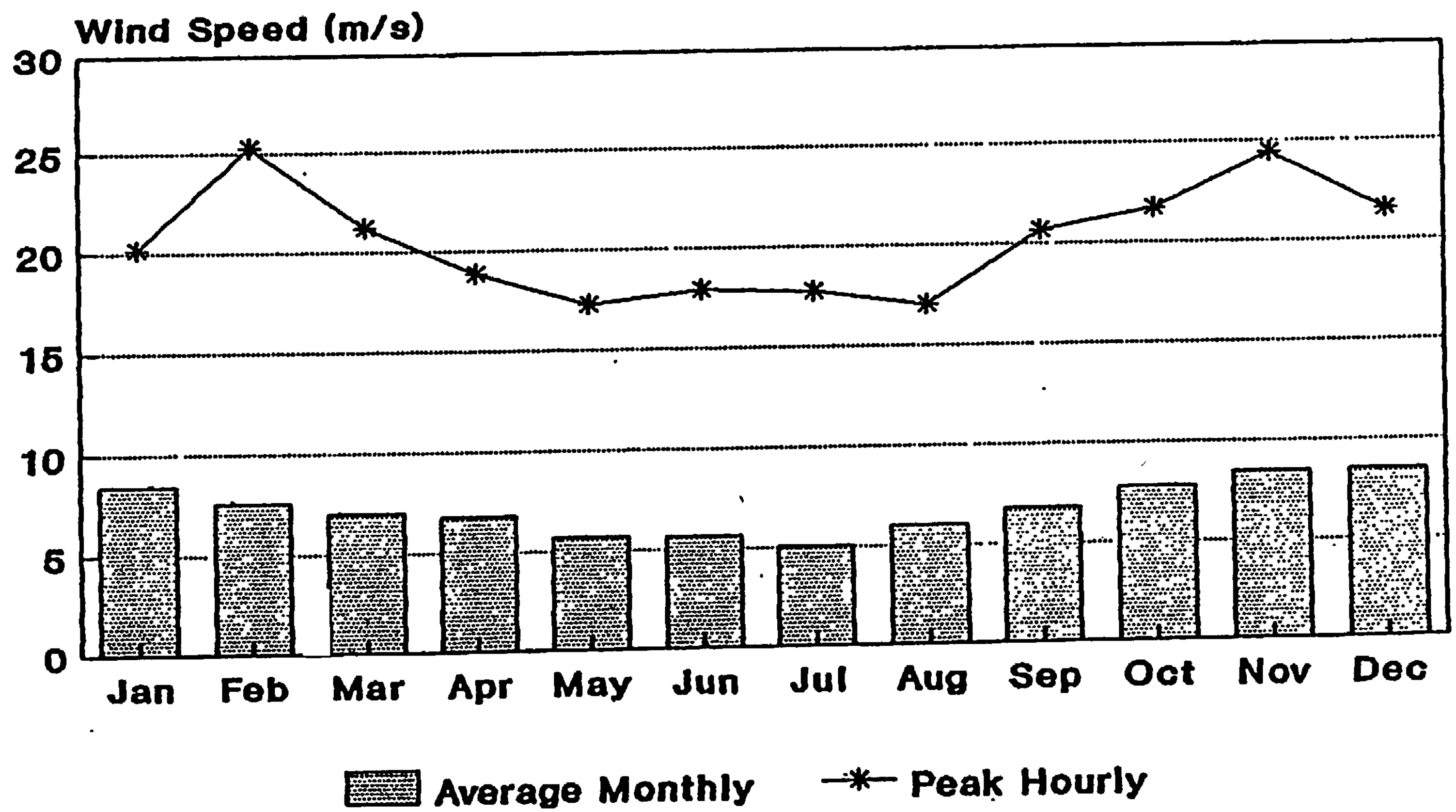
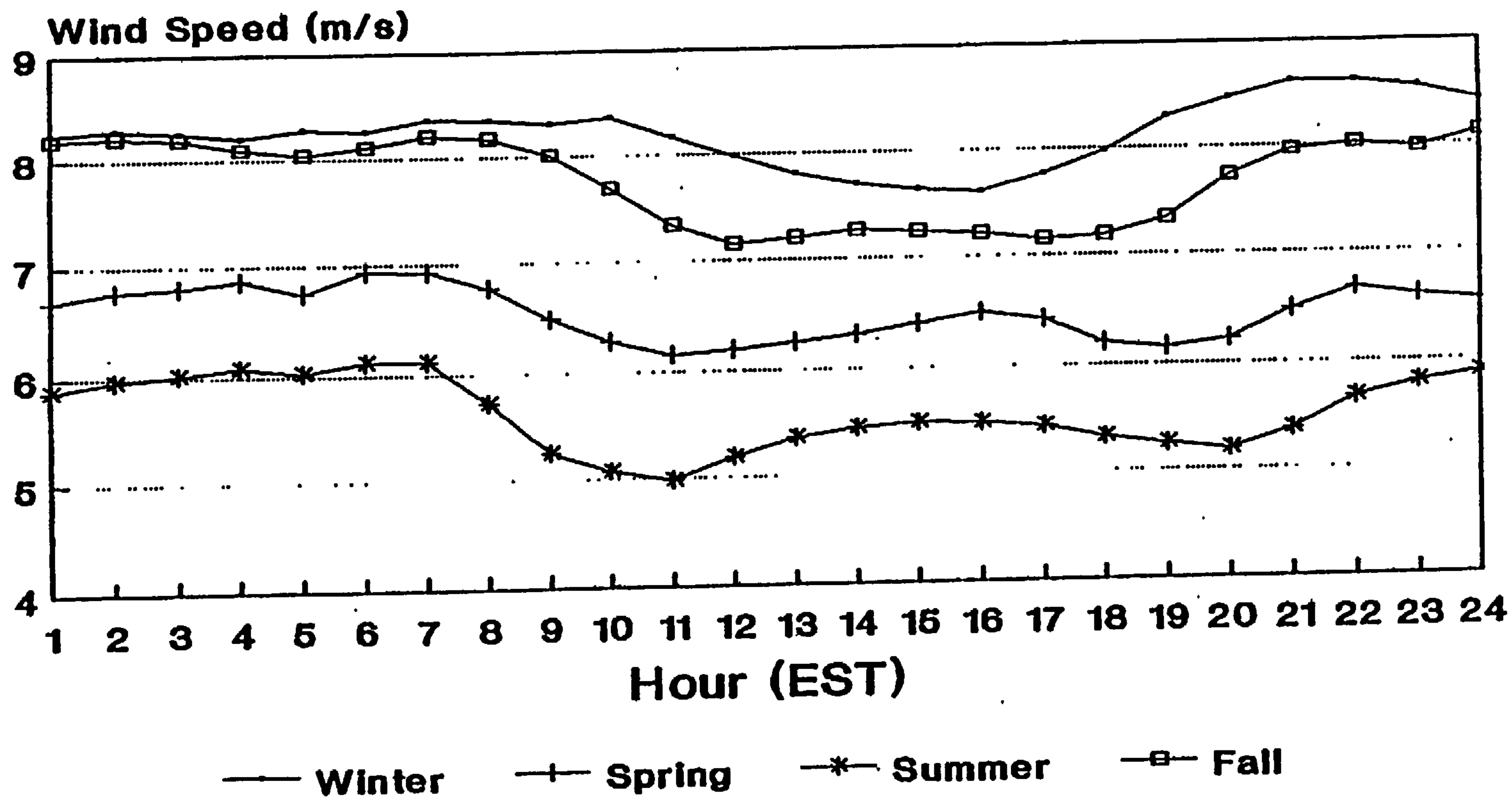


Figure 3.3-12
AVERAGE AND PEAK WIND SPEEDS, BIG ROCK POINT



1985-1992 Data

Figure 3.3-13
AVERAGE HOURLY WIND SPEED, BIG ROCK POINT



1985-1992 Data

Figure 3.3-14
THUNDERSTORM FREQUENCY, BIG ROCK POINT

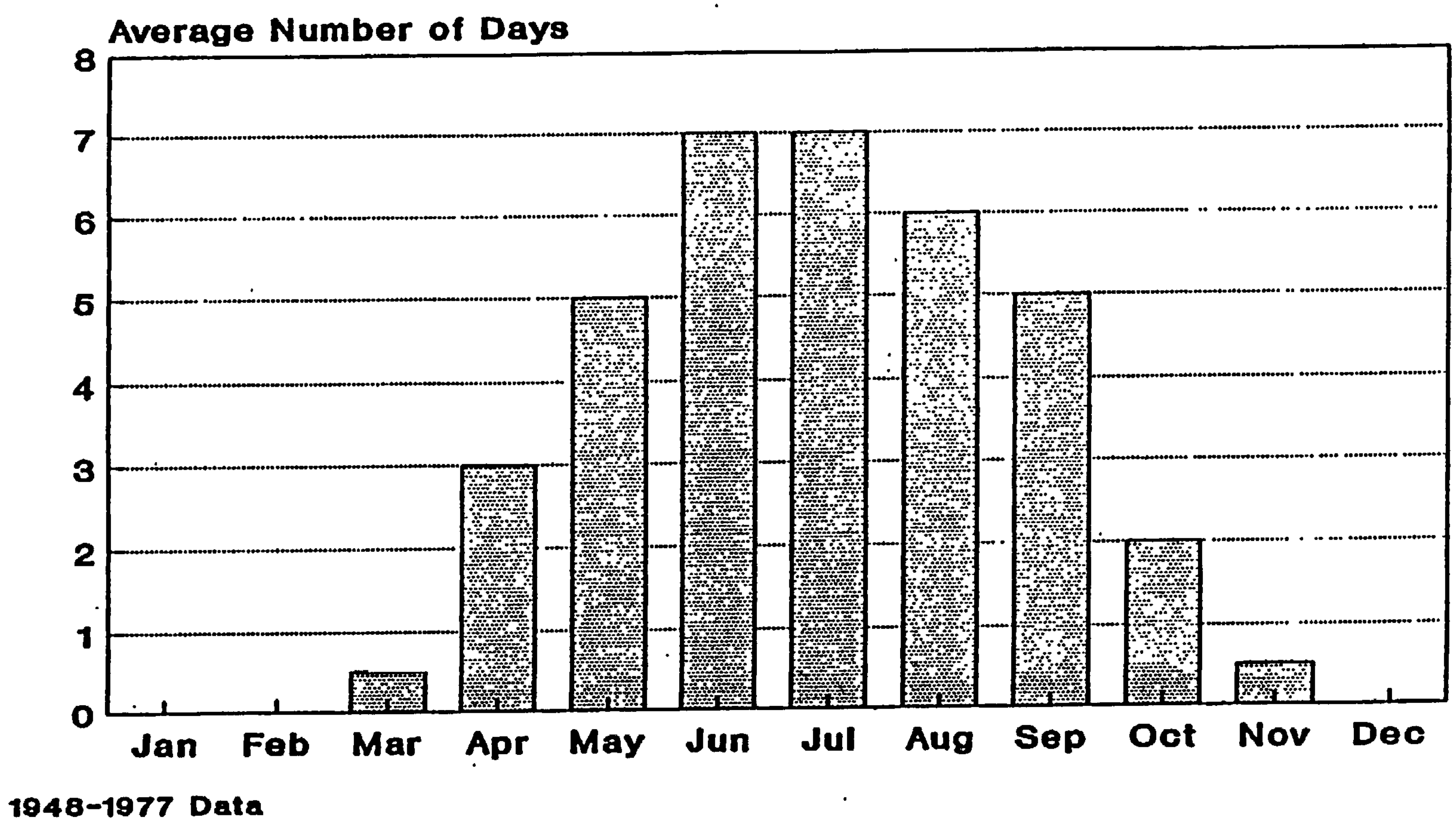


Figure 3.4-1
<u>REGION WATERSHED</u>

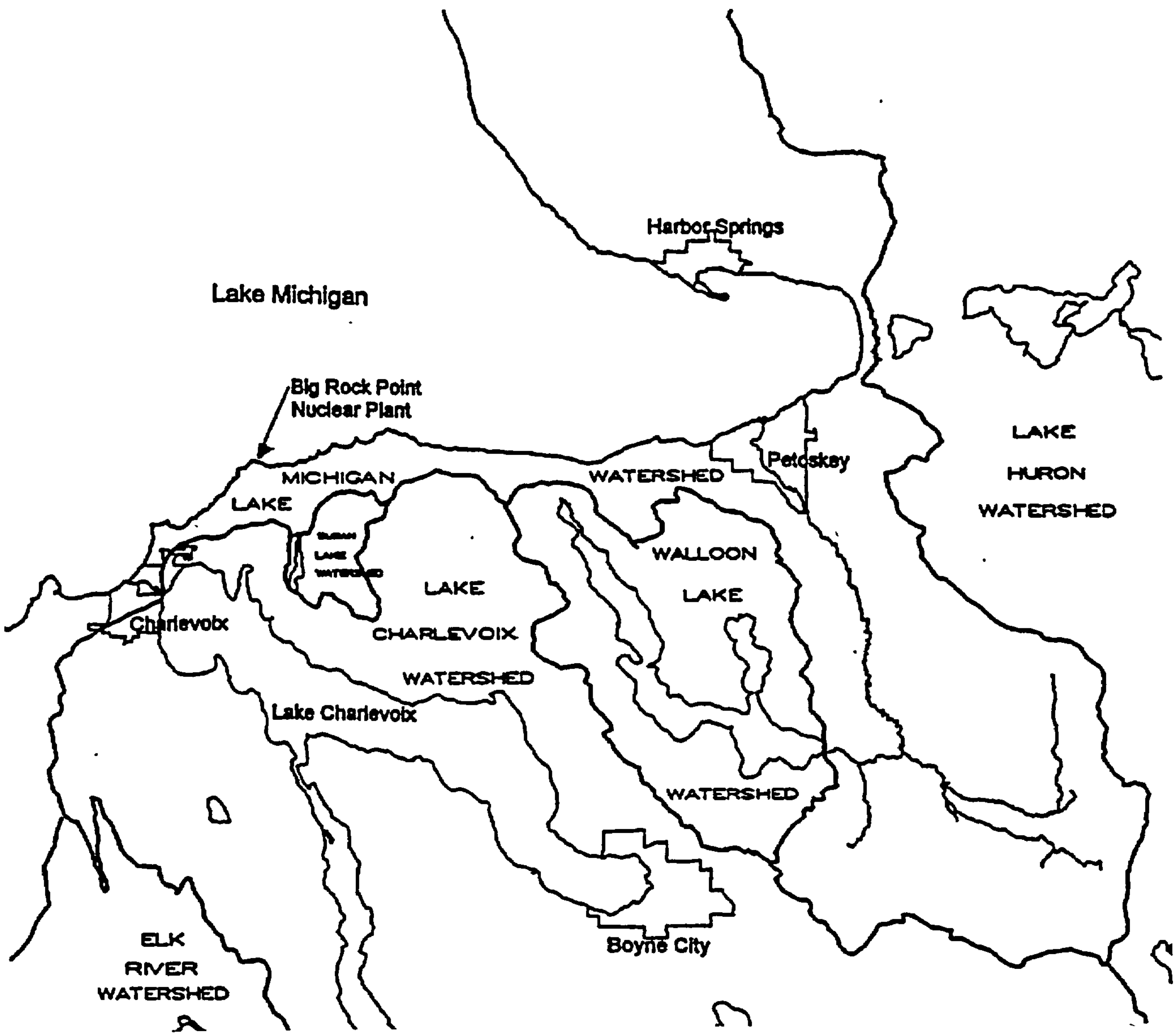


TABLE 3.1-1

PERMANENT RESIDENTIAL POPULATION WITHIN 5 MILES OF BIG ROCK POINT NUCLEAR PLANT[1]

	Distance to Plant (Miles)					
Sector[2]	0-1	1-2	2-3	3-4	4-5	TOTAL
N	0	0	0	0	0	0
NNE	0	0	0	0	0	0
NE	0	0	0	0	0	0
ENE	0	0	14	22	0	36
E	0	23	39	55	69	186
ESE	0	23	39	55	69	186
SE	0	23	39	55	69	186
SSE	0	23	39	55	69	186
S	0	23	39	22	0	84
SSW	0	23	39	0	144	206
SW	86	23	144	673	1805	2731
WSW	0	0	0	0	0	0
W	0	0	0	0	0	0
WNW	0	0	0	0	0	0
NW	0	0	0	0	0	0
NNW	0	0	0	0	0	0
TOTALS	86	161	392	937	2225	3801

[1] Reference 3.1-2 based on 2000 Census Bureau data distributed by township.
[2] Sectors W to NE extend over Lake Michigan.

TABLE 3.1-2

PERMANENT RESIDENTIAL POPULATION WITHIN 50 MILES OF BIG ROCK POINT NUCLEAR PLANT[1]

	Distance to Plant (Miles)						
Sector	0-5	5-10	10-20	20-30	30-40	40-50	TOTAL
N	0	0	0	0	0	220	220
NNE	0	84	697	523	86	1501	2891
NE	0	519	1335	2315	2523	3446	10138
ENE	36	434	5542	3226	5164	9336	23738
E	186	992	9932	5089	2244	2190	20633
ESE	186	1400	3245	1498	1952	2162	10443
SE	186	1096	5780	2009	11673	6905	27649
SSE	186	500	3754	1660	5717	3194	15019
S	84	812	4265	5085	4445	8304	22995
SSW	206	895	1729	2268	7238	28214	40550
SW	2731	2428	500	1070	6284	7062	20075
WSW	0	0	0	0	0	0	0
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
NW	0	0	0	195	202	0	397
NNW	0	0	0	0	154	36	190
TOTAL	3801	9160	36,779	24,938	47,682	72,570	194,930

[1]Reference 3.1-2 based on 2000 Census Bureau data distributed by township.

TABLE 3.1-3

CENSUS DATA FOR MUNICIPALITIES WITHIN 50 MILES OF BIG ROCK POINT NUCLEAR PLANT

City	Permanent Residential Population[1]						Distance from Site (miles)
	1960	1970	1980	1990	2000	% Change 1960 - 2000	
Charlevoix	2751	3519	3296	3116	2994	8.8	4
Petoskey	6138	6342	6097	6056	6080	(1.0)	11
Harbor Springs	1433	1662	1567	1540	1540	7.5	11
Boyne City	2797	2969	3348	3478	3478	24.3	14
East Jordan	1919	2041	2185	2240	2240	16.7	14
Gaylord	2569	3012	3011	3256	3256	26.7	33
Cheboygan	5859	5553	5106	4999	5295	(9.6)	40
St. Ignace	3334	2892	2632	2568	2568	(23.0)	42
Traverse City	18,432	18,048	15,516	15,116	14,532	(21.2)	45

[1]Data for 1960, 1970, 1980 obtained from BRP Nuclear Plant FHSR.
1990 data obtained directly from U.S. Census Bureau, Detroit, MI Office.
2000 data obtained from US Census Bureau web site.

TABLE 3.1-4

CENSUS DATA FOR COUNTIES
NEAR BIG ROCK POINT NUCLEAR PLANT

County	Permanent Residential Population[1]					% Change 1960 - 2000
	1960	1970	1980	1990	2000	
Antrim	10,373	12,612	16,194	18,185	23,110	123 %
Charlevoix	13,427	16,541	19,907	21,468	26,090	94 %
Emmet	15,904	18,331	22,992	25,040	31,437	98 %

[1]Compiled from Emmet County/City of Petoskey Comprehensive Plan, BRP Nuclear Plant FHSR and 1990 and 2000 Census data.

TABLE 3.1-5

1998 BIG ROCK POINT NUCLEAR PLANT LAND USE CENSUS[1]

Sector[2]	Nearest Distance (miles)				Number/Type[5]
	Residence[3]	Garden	Dairy Animal[4]	Beef Cattle	
WSW	2.5	>5	>5	>5	
SW	1.1	2.7	>5	>5	1 garden
SSW	1.3	>5	>5	>5	
S	1.9	2.1	>5	>5	1 garden
SSE	1.7	1.7	>5	1.7	3 gardens 43 beef cattle
SE	1.8	1.8	4.5	1.7	1 garden 20 dairy cows 32 beef cattle
ESE	1.5	1.8	>5	3.2	6 gardens 65 beef cattle
E	1.4	2.4	3.5	3.2	1 garden 130 dairy cows 4 beef cattle
ENE	2.3	>5	>5	>5	

Notes: [1]Source: Reference 3.1-9
[2]Sectors not identified extend over Lake Michigan.
[3]Only the distance to the *nearest* resident is provided.
[4]Nearest milk animals are dairy cows, except in SE sector where closest is a goat.
[5]All milk animals within 5 miles and gardens greater than 500 ft^2 within 3 miles.

TABLE 3.2-1
WATER QUALITY IN THE VICINITY OF BIG ROCK POINT NUCLEAR PLANT

Parameter	Location			
	BRP Discharge Canal February 1992[1]	Little Traverse Bay April 1987[2]	Little Traverse Bay May 1992[3]	Charlevoix Harbor Area 6 May 1985[4]
Physical				
Conductivity (µmho/cm)	265	252	237	190
Turbidity (NTU)	< 0.5	-	-	-
Secchi Disk (ft)	-	19.5	20	5.2
TSS (mg/l)	< 1	-	-	2
TDS (mg/l)	212	-	-	190
Chlorophyll-a (µg/l)	2.8	-	-	-
Chemical				
DO (mg/l)	-	9.2	12.8	12.2
pH	7.9	7.9	7.9	7.9
Alkalinity (mg/l)	-	-	105	-
Ammonia-N (mg/l)	< 0.14	0.014	< 0.1	0.01
Nitrate/Nitrite-N (mg/l)	< 0.1	0.205	< 0.5	-
Total Phosphorus (mg/l)	-	0.018	0.005	0.11
Chloride (mg/l)	9	7.8	9	-

[1]Reference 3.2-5
[2]Reference 3.2-3
[3]Reference 3.2-4
[4]Reference 3.2-6

TABLE 3.2-2

CREEL DATA FOR LAKE MICHIGAN, CHARLEVOIX COUNTY[1]
(All modes of sportfishing and charter boat excursion)

Species	Sportfishing (catch/hr)	Charter Fishing (catch/hr)
Pink salmon	0.0002	NA
Coho salmon	0.0001	0.0000
Chinook salmon	0.0362	0.3099
Rainbow trout	0.0009	0.0176
Brown trout	0.0049	0.0704
Lake trout	0.0599	3.2500
Channel catfish	0.0016	NA
Walleye	0.0002	0.0106
Burbot	0.0001	NA

NA - not available
[1]Reference 3.2-12

TABLE 3.2-3

POUNDS OF CHINOOK SALMON HARVESTED FROM MICHIGAN WEIRS, LAKE MICHIGAN DURING THE FALL OF 1991-1993

HARVEST WEIR	SEX	1991	1992	1993
Boardman River	Jacks	5,259	4,553	6,775
	Males	39,595	16,279	7,614
	Females (Whole)	27,431	21,170	8,860
	Females (Stripped)	0	0	0
	WEIR TOTALS	**72,285**	**42,002**	**23,249**
Little Manistee River	Jacks	29,533	16,659	16,655
	Males	116,588	83,032	70,961
	Females (Whole)	37,784	46,334	21,194
	Females (Stripped)	657	40,865	0
	WEIR TOTALS	**229,562**	**186,890**	**42,452**
Medusa Creek	Jacks	1,963	6,988	7,500
	Males	18,447	20,957	12,640
	Females (Whole)	4,465	24,535	12,699
	Females (Stripped)	0	0	0
	WEIR TOTALS	**24,875**	**52,480**	**32,839**
Upper Platte River	Jacks	1,861	0	188
	Males	896	0	75
	Females (Whole)	169	0	90
	Females (Stripped)	0	0	0
	WEIR TOTALS	**2,926**	**0**	**353**
All Weirs	Jacks	49,513	34,412	34,831
	Males	190,693	147,746	108,835
	Females (Whole)	78,991	107,097	69,151
	Females (Stripped)	45,657	40,865	38,999
	WEIR TOTALS	**364,854**	**330,120**	**251,816**

TABLE 3.2-4

LIST OF FISH SPECIES COLLECTED IN LAKE MICHIGAN NEAR BIG ROCK POINT NUCLEAR PLANT

Common Name	Scientific Name
Lake trout	*Salvelinus namaycush*
Brown trout	*Salmo trutta*
Rainbow trout	*Oncorhynchus mykiss*
Chinook salmon	*Oncorhynchus tshawytscha*
Coho salmon	*Oncorhynchus kisutch*
Bloater chub	*Coregonus hoyi*
Lake whitefish	*Coregonus clupeaformis*
Round whitefish	*Prosopium cylindraceum*
Burbot	*Lota lota*
Yellow perch	*Perca flavescens*
White sucker	*Catostomus commersoni*
Longnose sucker	*Catostomus catostomus*
Smallmouth bass	*Micropterus dolomieu*
Rock bass	*Ambloplites rupestris*
Northern pike	*Esox lucius*
Alewife	*Alosa pseudoharengus*
Smelt	*Osmerus mordax*
Spottail shiner	*Notropis hudsonius*
Channel catfish	*Ictalurus punctatus*
Carp	*Cyprinus carpio*

TABLE 3.2-5
BIG ROCK POINT SOIL TYPE AND LAND COVER ACREAGE WITHIN CONSUMERS ENERGY COMPANY PROPERTY BOUNDARY

SOIL TYPE	ACREAGE
AgB - Alpena gravelly sandy loam, 0-6 percent slopes	184.7
DeB - Detour cobbly loam, 0-6 percent slopes	227.9
EdB - Eastport sand, 0-6 percent slopes	4.0
EoF - Emmet-Onaway sandy loam, 25-50 percent slopes	17.3
Hs - Hessel cobbly loam	104.8
Lb - Lake beach	26.5
Rc - Roscommon sand	1.2
TOTAL SOIL TYPE	566.4
LAND COVER	
146 - Utilities	15.8
31 - Herbaceous Openland	35.0
32 - Shrubland	6.8
41104 - Northern hardwood; poletimber, poor stocking	1.9
41108 - Northern hardwood; sawtimber, medium stocking	10.6
41109 - Northern hardwood; sawtimber, well-stocked	15.5
41305 - Aspen/White Birch; poletimber, medium stocking	59.2
41306 - Aspen/White Birch; poletimber, well-stocked	37.3
41464 - Lowland hardwood (aspen); poletimber, poor stocking	34.6
41465 - Lowland hardwood (aspen); poletimber, medium stocking	79.1
41466 - Lowland hardwood (aspen); poletimber, well-stocked	20.5
41468 - Lowland hardwood (aspen); sawtimber, medium stocking	10.9
41469 - Lowland hardwood (aspen); sawtimber, well-stocked	88.0
42205 - Upland conifer; poletimber, medium stocking	74.8
42206 - Upland conifer; poletimber, well-stocked	21.8
42304 - Lowland conifer; poletimber, poor stocking	23.8
42305 - Lowland conifer; poletimber, medium stocking	15.2
42306 - Lowland conifer; poletimber, well-stocked	8.9
72 - Beach	6.8
TOTAL LAND COVER	566.5

TABLE 3.2-6
BIG ROCK POINT SITE WILDLIFE

COMMON NAME	SCIENTIFIC NAME
Birds:	
Chickadee	*Parus atricapillus*
White-breasted nuthatch	*Sitta carolinensis*
Robin	*Turdus migratorius*
Mourning dove	*Zenaida macroura*
Dark-eyed junco	*Junco hyemalis*
Common flicker	*Colaptes auratus*
Cardinal	*Cardinalis cardinalis*
Blue jay	*Cyanocitta cristata*
Pink grosbeak	*Pinicola enucleator*
Evening grosbeak	*Coccothraustes vespertinus*
Ruffed grouse	*Bonasa umbellus*
Wood duck	*Aix sponsa*
Mallard	*Anas platyrhynchos*
Mute swan	*Cygnus olor*
Canada goose	*Branta canadensis*
Herring gull	*Larus argentatus*
Ring billed gull	*Larus delawarensis*
Snowy egret	*Egretta thula*
Killdeer	*Charadrius vociferus*
Song sparrow	*Melospiza melodia*
Brown-headed cowbird	*Molothrus ater*
Purple finch	*Carpodacus purpureus*
American goldfinch	*Carduelis tristis*
Pileated woodpecker	*Dryocopus pileatus*
Hairy woodpecker	*Picoides villosus*
Downy woodpecker	*Picoides pubescens*
Crow	*Corvus brachyrhynchos*
Raven	*Corvus corax*
Arctic owl	*Nyctea scandiaca*
Tree swallow	*Tachycineta bicolor*

TABLE 3.2-6
BIG ROCK POINT SITE WILDLIFE

COMMON NAME	SCIENTIFIC NAME
Red-eyed vireo	*Vireo olivaceous*
American redstart	*Setophaga ruticilla*
White-throated sparrow	*Zonotrichia albicollis*
Scarlet tanager	*Piranga olivacea*
Great crested flycatcher	*Myiarchus crinitus*
Blue heron	*Ardea herodias*
Bald eagle	*Haliaeetus leucocephalus*
Turkey	*Meleagris gallopavo*
Mammals:	
Raccoon	*Procyon lotor*
Red squirrel	*Tamiasciurus hudsonicus*
Chipmunk	*Tamies striatus*
Opossum	*Didelphis virginianus*
Badger	*Taxidea taxus*
Skunk	*Mephitis mephitis*
Deer	*Odocoileus virginianus*
Mink	*Mustela vison*
Bear	*Ursus americanus*
Woodchuck	*Marmota monax*
White-footed mouse	*Peromyscus leucopus*
Porcupine	*Erithizon dorsatum*
Cottontail rabbit	*Sylvilagus floridanus*
Snowshoe hare	*Lepus americanas*
Red fox	*Vulpes fulva*
Bobcat	*Lynx rufus*
Coyote	*Canis latrans*

4.0 INTRODUCTION

This chapter addresses the environmental impact assessment for the process of decommissioning the Big Rock Point Nuclear Plant. The assessment establishes that the environmental effects for decommissioning of Big Rock Point Nuclear Plant are minimal, and that there are no adverse effects outside the bounds of NUREG-0586, the Final Generic Environmental Impact Statement (FGEIS) [Reference 1.3-1].

The Big Rock Point Post Shutdown Activities Report (PSDAR) describes planned decommissioning activities, a schedule for their completion, and estimates of expected costs. The information contained in the PSDAR is utilized as the basis for this assessment of radiological and non-radiological affects of decommissioning. These conclusions are summarized as follows:

a. Annual occupational radiation exposures per individual will be maintained below historical levels for the operating phase of the plant.

b. All effluents, both radiological and non-radiological, will remain within regulatory limits throughout the decommissioning process.

c. Exposure to onsite workers and the offsite public as a result of waste transportation are expected to be maintained well below the levels projected by the FGEIS.

d. Following decommissioning, residual radioactivity will be limited to allow release of the property for unrestricted use such that an individual of a critical population group living on the site would not be expected to receive a dose greater than 25 millirem/year from all combined environmental exposure pathways.

4.1 OCCUPATIONAL RADIATION EXPOSURE

The Big Rock Point Radiation Protection Program is applied to all activities involving radiological hazards. The program is based on the premise that all exposures should be reduced to levels which are as low as reasonably achievable (ALARA), to both the individual worker and to the work force as a whole.

Engineering controls are utilized to minimize internal dose from inhalation of airborne radioactive materials, with personal respiratory protective devices used as a last resort when TEDE is shown to be ALARA and no other hazardous airborne contaminants exist.

4.1.1 Estimated Occupational Radiation Exposure

The total decommissioning dose is estimated to be 700 person-Rem. Dose projections for the next calendar year are completed annually based on specific planned work activities. Major contributors to doses during dismantlement are handling and shipping of major Nuclear Steam Supply System components (reactor vessel, steam drum, pipes and pumps); dismantlement of the radwaste system; and the handling and shipping of low level radioactive waste.

The following table provides the cumulative occupational radiation doses since plant shutdown for decommissioning.

Year	Dose Received (Person-Rem)	Comments
1997	31.0	Post shutdown dose August – December 1997
1998	104.0	
1999	87.0	
2000	89.0	

4.1.2 Occupational Radiation Exposure Comparison to FGEIS

Occupational radiation exposure at Big Rock Point is controlled in accordance with 10CFR20, Standards for Protection Against Radiation. The requirements of 10CFR20 are implemented through a comprehensive radiation protection program.

The total decommissioning dose is estimated to be 700 person-rem. This estimate is derived from the original five-year SAFSTOR dose estimate and was adjusted by the factor of radioactive decay that would have occurred if the five-year SAFSTOR option had been utilized. The immediate dismantlement (DECON option) dose estimate is significantly lower than the value of 1874 person-rem for a boiling water reactor facility identified in the FGEIS [Reference 4.1-1]. A chemical decontamination of the primary Nuclear Steam Supply system was completed in 1998, resulting in removal of approximately 435 Curies of radioactivity. The performance of the chemical decontamination negates the disadvantage of the DECON option as discussed in the FGEIS. The 700 person-rem estimate for the Big Rock Point Restoration Project is within the 834 person-rem value for a boiling water reactor facility for ten-year SAFSTOR.

4.1.2.1 Method of Occupational Dose Calculation

Relative dose contribution by nuclide for plant systems of major dose consequence, as determined during plant operational outages, was used as the basis for occupational dose calculation. In-situ gamma spectrum analysis, followed by dose computation by means of photon fluence to dose conversion, was utilized to determine dose contribution by isotope [Reference 4.1-2]. The data at 30 days after shutdown indicate that approximately 70% of external dose is caused by Co-60, 24% by Mn-54, 3% by Cs-137 and 3% by shorter halflife radionuclides. Based on the halflives of each nuclide, external dose contributions from all but Co-60 and Cs-137 become negligible within the first two years after shutdown.

For dose estimation of tasks not routinely performed during plant operations or previous outages, currently available area dose rate data, adjusted for decontamination or shielding as appropriate, are utilized. Estimated time at the work location multiplied by these dose rates provide the basis for the craft worker dose estimates. Other doses are estimated on the basis of similar non-routine work performed at the plant in the past, and studies performed previously in anticipation of similar work. Review has been made of staffing level estimates by job skill category to assure that individual workers would not exceed 2,000 mrem total effective dose equivalent (TEDE) in a yearly interval (Big Rock Point control level).

These estimates are refined during the planning and engineering for the decommissioning work packages. Dose estimates, job controls and appropriate dose reduction techniques will be developed in accordance with ALARA engineering and planning requirements utilizing current dose rates and plant conditions.

4.1.3 Options for Decontamination in Support of ALARA

Decontamination operations in support of ALARA are difficult tasks for dose assignment. The wide variation in dose estimates for system decontamination are documented in NUREG/CR-0672, Addendum 4 [Reference 4.1-3]. System decontamination costs are included in decommissioning cost analyses. ALARA techniques most effective in reduction of overall dose will be used.

4.1.4 Radiation Safety Program

The requirements of 10CFR parts 19 and 20 are implemented by administrative and working level plant procedures. The Radiation Safety Program is based on the premise that radiation dose, in units of total effective dose equivalent (TEDE), to workers and the public must be maintained as low as is reasonably achievable (ALARA), and in no case should doses or effluent levels exceed regulatory limits. The program is comprised of the elements described in Sections 4.1.4.1 through 4.1.4.3.

4.1.4.1 ALARA Program

The ALARA Program utilizes ALARA reviews in initial engineering phases as well as ALARA job planning and dose estimates or goals for major tasks, work groups and individual workers. Radiation doses and inhalation exposures of airborne radioactive materials at defined levels are tracked and reported to workers and their supervision on a routine basis for periodic review. If doses approach established control levels (well below regulatory levels), additional review of the circumstances causing dose increase to these levels is performed. Any necessary actions are taken to reduce exposure rates, and dose increases above the control level must be authorized or denied. Reviews are performed at various administrative levels, with the highest doses requiring the highest level of management review. Both contract and company employees are covered by these procedures.

Specific techniques of dose reduction which are considered in job planning include shielding, decontamination, special training (including mockup training or special tests of tools and procedures as appropriate), special remote tools, remote monitoring by video, use of alarming dosimeters, use of minimum effective crew size and other items, including suggestions from workers, which might reduce dose while permitting safe execution of the task. Engineering work must consider similar items to ensure that designs minimize worker dose as well as potential for environmental release.

Files are maintained which include the history of various types of work in radiation and contamination areas throughout the plant. These files include photographs of equipment (when available), description of tasks, levels of radiation and airborne radioactivity encountered during work, and any problems or unexpected events which occurred. Since plant conditions have changed since the operational phase, these history files are utilized as applicable for planning decommissioning work packages.

4.1.4.2 Radiation Respiratory Protection Program

The Radiation Respiratory Protection Program is a continuation of the ALARA program into the area of airborne radioactivity intake. The policy is to maintain total effective dose equivalent (TEDE) ALARA, regardless the mix of internal and external exposure. Whenever practicable, engineering features are used to control airborne radioactivity. These features include installed ventilation, special mobile filter units, work enclosures and other methods of maintaining the breathing zone at minimal levels of radioactivity. Individual respiratory protective devices may be utilized if such use minimizes TEDE or is required by other workplace hazards, e.g. asbestos, lead, etc.

The Big Rock Point radiation respiratory protection program meets all requirements of 10CFR20, Subpart H, Respiratory Protection and Controls to Restrict Internal Exposure in Restricted Areas (20.1701 through 20.1704).

4.1.4.3 Radioactive Materials and Contamination Control

Control of radioactive materials for Big Rock Point decommissioning involves the control of sources activated or contaminated due to plant operation, as well as those sealed sources licensed to the plant or its contractors for use in instrument calibrations or radiographic work, etc. Activated and contaminated materials are controlled predominantly by work practices and procedures specific to decommissioning tasks involving work in radiation and contamination areas, and for handling radioactive waste. Sealed sources are controlled by procedures for use, inventory and accountability. These controls are applied as a portion of the overall program of minimizing radiation exposure to both workers and members of the public.

Controls are provided in the areas of:

a. Personnel contamination control,

b. Controls to minimize spread of contamination,

c. Labeling of radioactive materials,

d. Receipt of radioactive materials,

e. Release of materials for unrestricted use,

f. Handling of radioactive materials for storage and shipment,

g. Liquid and gaseous release, and

h. Sealed source accountability.

4.2 OFFSITE RADIATION EXPOSURE AND MONITORING

Releases of radioactive liquid and gaseous effluents during the decommissioning period are minimized by use of existing radioactive effluent treatment systems until such time as those systems are deactivated in the decommissioning process. Temporary systems may be utilized, as necessary to meet the objectives of maintaining doses to the public ALARA as identified by 10CFR50, Appendix I. Effluent monitoring or sampling systems will be maintained either by use of existing monitoring systems, or by temporary installation, at times of release, of monitoring or sampling instruments of as high or higher sensitivity than those currently installed.

The Radiological Environmental Monitoring Program (REMP) has been modified to monitor specifically for the effects of decommissioning activities as described in the Offsite Dose Calculation Manual (ODCM) [Reference 4.2-1]. Detailed discussion of environmental monitoring is found in Section 6.1 of this Environmental Report.

4.2.1 Environmental Exposure Limits

Effluent releases will be controlled in a manner consistent with maintaining public doses ALARA as defined by 10CFR50, Appendix I, and in compliance with 10CFR20. In addition, an unrestricted site release limit of 25 millirem/year TEDE to the average individual of the critical population group postulated to exist at or near the site over the 1000 years following. Big Rock Point will meet this limit for unrestricted use.

4.2.2 Conservative Dose Estimates

Dose estimates have been performed for public exposures due to trace amounts of residual contamination at the plant site following site release, and for exposures from effluents during the decommissioning period.

4.2.2.1 Doses Following Site Release

An agriculturally based residential population group would be the "Critical Population Group" in terms of dose consequences. However, as addressed in Section 3.2 of this Environmental Report, soil characteristics at the Big Rock Point site are poorly suited to agricultural activities. In addition, the site is poorly suited to agriculture due to the value of Lake Michigan shoreline. This high capital cost makes farming uneconomic, although small residential gardens are possible.

4.2.2.2 Doses from Effluents during Decommissioning

Effluent release quantity projections are based on the assumption that release quantities were highest in the year of final plant shutdown (1997) and the year following (1998). Gaseous emissions decreased immediately upon plant shutdown while liquid radioactivity decreases more slowly due to the presence of Cs-137 and Co-60 with their longer halflives.

The current Offsite Dose Calculation Manual (ODCM), modified as necessary to reflect decommissioning activities, is utilized to comply with the annual dose guidelines of 10CFR50, Appendix I:

a. Liquid effluents not to exceed 3 mrem whole body
- 10 mrem any organ

b. Gaseous Particulates not to exceed - 15 mrem to any organ
(all pathways, isotopes (with half-lives > 8 days)

Maintaining effluents within these guidelines, as well as the effluent concentration limits of 10CFR20, Appendix B, will serve to maintain public doses well within the 25 millirem per year EPA standard set forth in 40CFR190.

Actual doses during decommissioning are expected to be small fractions of the above values. Annual doses to the public during Big Rock Point's operating period and the initial phase of decommissioning have not exceeded 0.5 millirem for liquid effluents and 0.1 millirem from gaseous effluents, as committed since 1976 under 10CFR50, Appendix I. Both liquid and gaseous effluent doses are calculated using the standard models of Regulatory Guide 1.109, applying site-specific parameters of meteorology, dilution factor to the nearest public water supply, nearby recreational activity and critical receptors (residence, cow, goat, vegetable garden, etc). In addition monthly, quarterly and annual dose calculations are performed prior to each batch release (or continuous gaseous release) to assure that the guidelines are not exceeded prior to completion of the release.

4.2.2.3 Reporting

Reports of radioactive effluents released and radioactive waste shipped from Big Rock Point are submitted annually to the NRC. The values in this report provide the basis for input to the dose models for offsite dose calculations described above.

4.2.3 Transportation

Doses due to transportation of radioactive waste are bounded by the FGEIS. The much smaller size of Big Rock Point as compared to the reference BWR results in volumes and total quantities of radioactivity required for shipment which are on the order of 15-20% of the assumed in Appendix N of the FGEIS. The quantity of radioactivity for BRP waste is offset somewhat by a longer shipping distance for the higher activity wastes (800 km assumed in the FGEIS versus 1900 km to Barnwell, via the waste processor, for Big Rock Point). The majority of the lowest activity wastes designated for disposal are shipped to Envirocare in Utah (via the BRP waste processor), the very low dose rates compensate for the longer travel time. Overall, both occupational and public doses remain bounded by the FGEIS calculations.

4.2.4 Dose Effects - Summary

Decommissioning of Big Rock Point Nuclear Plant will not increase either public exposure above levels experienced during plant operation nor is it expected to increase occupational exposures significantly above levels experienced during plant operation.

Doses to workers and to the public during decommissioning operations will remain within the limits of 10CFR20, and are expected to represent small fractions of those limits. Doses to the average member of any critical population group at the site following release for unrestricted use also will meet applicable limits.

4.3 RADIOACTIVE WASTE MANAGEMENT

Big Rock Point's decommissioning requires handling of a large volume of radioactive materials to reduce residual radioactivity to a level permitting release of the site for unrestricted use and termination of its license. Materials that cannot be decontaminated to the level below the radioactive release criteria are processed as radioactive waste.

Big Rock Point ensures appropriate processing, packaging, and control of solid, liquid, and gaseous wastes during decommissioning by implementing requirements of plant procedures, the Process Control Program, the Radiological Environmental Monitoring Program and the Offsite Dose Calculation Manual. These programs and procedures are maintained in compliance with Defueled Technical Specification requirements.

4.3.1 Spent Fuel Management

The Spent Fuel Pool will remain operational for as long as spent fuel is stored in the pool. Once fuel is transferred to a dry transportable canister system, the pool will no longer be needed nor maintained. Operation of the pool requires that the water be purified, cooled, and replenished with make-up water. In addition, the Containment Building continues to be heated.

4.3.1.1 Spent Fuel Pool Design and Operation

Purification and cooling of the water in the Spent Fuel Pool is accomplished by the alternate liquid radioactive waste processing skid and spent fuel pool cooling skid, respectively. These systems were upgraded in 1998 and 1999 and are intended to remain in operation until all fuel is removed from the spent fuel pool. An emergency water source for make-up to the Spent Fuel Pool is the fire suppression system.

The Spent Fuel Pool chemistry, temperature, and level is monitored on a routine basis in accordance with Defueled Technical Specifications. The water functions as a heat sink for the spent fuel decay heat and provides radiation shielding of the spent fuel. The water quality minimizes age-related degradation of the components in the Spent Fuel Pool and, therefore, helps to ensure the continued integrity of the Spent Fuel Pool stainless steel liner and spent fuel racks. These actions are responsive to NRC concerns expressed in NRC Bulletin 94-01 [Reference 4.3-1].

The spent fuel storage racks and Spent Fuel Pool concrete structure and stainless liner have been evaluated for structural integrity during the planned storage period. The evaluations support continued operation throughout the storage period [References 4.3-2 and 4.3-3].

4.3.1.2 Dry Transportable Canister System

Spent fuel is currently planned to be stored wet in the spent fuel pool until dry transportable storage canisters are available, and fuel has decayed sufficiently to meet license conditions of the canisters. Loading of dry storage canisters is planned to begin in mid 2002 with completion of the fuel pool offload by the end of 2002. An onsite Independent Spent Fuel Storage Installation (ISFSI) will accommodate all current spent fuel in seven storage casks; each cask will contain two canisters. Fuel is expected to be retained onsite until Department of Energy (DOE) fulfills their obligation to receive the fuel.

4.3.2 Solid Radioactive Waste Processing

Solid radioactive waste handling at Big Rock Point is divided into three phases: (1) packaging, (2) on-site storage awaiting shipment, and (3) shipment. Each of these phases is implemented in strict compliance with Big Rock Point's Defueled Technical Specifications, Process Control Program, applicable federal, state regulations, disposal site requirements, and site procedures. The waste is then shipped to a licensed offsite processor for further processing such as decontamination for free release, metal melt, incineration or shipped directly to a licensed disposal facility.

Solid radioactive waste generated during the decommissioning of Big Rock Point is comprised of both high and low-level radioactive waste. Several of the reactor vessel internal components have radionuclide concentrations in excess of the 10CFR61, Class C limits. These materials are not acceptable for near-surface disposal and have been classified as high-level radioactive waste. Greater than Class C waste may be stored with the irradiated reactor fuel on the ISFSI and be shipped to a licensed facility when one becomes available. The reactor vessel may also be stored at the ISFSI location in a storage cask if shipment to a permanent disposal site is not possible during dismantlement.

4.3.2.1 Solid Radioactive Waste Packaging

Radioactive waste packaging at Big Rock Point is performed in established areas that minimize both the radiation exposure to personnel and movement of the contaminated material. The areas are controlled and monitored to ensure the ALARA philosophy is practiced to minimize worker exposure and the spread of contamination to the extent possible.

Radioactive waste packaging operations follow procedures that specify:

a. Work is performed under an issued radiation work permit,

b. Specific packaging requirements are identified and performed,

c. Quality assurance requirements for packaging operations are followed,

d. Appropriate monitoring of dose rates and contamination levels are performed and recorded for each package, and

e. Each package is appropriately marked, labeled, and inventoried.

Waste packages and packaging meet the applicable requirements of 49CFR, 10CFR71 and the disposal facility's site criteria for transportation and disposal for each decommissioning waste stream. Examples of the waste containers that are used are drums, steel boxes, steel liners, high integrity containers, sea-land containers, shielded casks, and other specialty containers.

Site procedures and the Process Control Program provide instructions for determining the 10CFR61 waste classification of radioactive waste. Procedures also provide instructions to determine the radionuclide content of a container through a combination of direct measurements, radiation shielding calculations, and use of applicable scaling factors.

4.3.2.2 Solid Radioactive Waste Storage Awaiting Shipment

Solid radioactive waste awaiting shipment are stored in areas selected, identified, and posted in accordance with procedures. These procedures address the requirements of 10CFR20. Periodic inspections will be performed to ensure that package integrity is maintained.

Large packages awaiting shipment are typically stored in the yard area prior to shipment. The packages are free of removable contamination or protected from the weather. Precautions are taken to ensure that the components are within barriers, as necessary, and adequately protected from on-site hazards (e.g., heavy load movement).

4.3.2.3 Solid Radioactive Waste Shipment

Solid radioactive wastes are shipped following site procedures. These procedures ensure compliance with applicable federal, state, and disposal site requirements. Prior to each shipment of a radioactive material package the quality control requirements of 49CFR173.475 are ensured.

Most radioactive material and waste shipments are completed over public highways. Local and state restrictions pertaining to radioactive material transport may affect some route selections. The carrier is responsible for selecting the appropriate route, which must conform to applicable federal, state, and local shipping requirements and be in accordance with Department of Transportation and NRC regulations.

4.3.3 Liquid Radioactive Waste Processing

Liquid radioactive waste is processed through a system that is designed to keep releases of radioactive materials to unrestricted areas as low as reasonable achievable. The liquid radioactive waste processing system was upgraded in 1999 with additional filtration and replacement of the demineralizer. Temporary liquid waste processing equipment may be necessary during the latter phases of decommissioning to facilitate the dismantlement of the installed liquid radioactive waste system.

Liquid radioactive waste is generated as a result of normal system processing and evolutions such as draining systems and decontamination of areas. Liquid radioactive waste is processed in accordance with the Offsite Dose Calculation Manual, Process Control Program, Defueled Technical Specifications, and site procedures which implement the higher level requirements.

4.3.4 Airborne Radioactive Waste Processing

Airborne radioactive waste processing consists of ventilation fans, ducting, dampers, louvers, filters, a 240-foot stack, controls and instrumentation. The purpose of the airborne waste processing system is to provide for the monitoring and control of airborne radioactive releases and provide sufficient ventilation to minimize airborne contamination within the plant. Exhaust air from the Containment Building and Turbine Building is discharged through the plant's stack.

Radioactive effluents are monitored by an installed stack monitoring system which continuously obtains an isokinetic sample from the stack. Plant procedures for sampling, measuring, and reporting radioactive airborne releases ensure that airborne releases are monitored and maintained within the limits of the Defueled Technical Specifications and the Offsite Dose Calculation Manual. Airborne radioactive emissions primarily consist of particulates originating from loose surface contaminated areas within the plant. The stack air monitoring system was upgraded in 1999 due to modified monitoring requirements resulting from permanent shutdown.

Dismantlement activities are designed to ensure that airborne releases are minimized and monitored to the maximum extent practicable by implementing the following considerations during detailed planning of decommissioning activities:

a. Maintaining an airborne waste processing system either with the existing equipment or with a temporary/portable system;

b. Using local HEPA filtration systems when activities could result in the release of significant radioactive particulates;

c. Establishing controls to require local monitoring at the point of release when temporary ventilation is utilized; and/or

d. Ensuring procedures for the analyses of airborne effluents through all significant pathways are utilized. These procedures implement the requirements of 10CFR50 dose limits and 10CFR20 concentration limits.

Airborne effluents from the plant are monitored and reported in accordance with approved plant procedures and Offsite Dose Calculation Manual requirements.

4.3.5 Mixed Low Level Radioactive/Hazardous Waste

Mixed waste may originate from chemicals, paint chips, raw lead (if it is not recycled), and specific dismantlement activities. While detailed planning is utilized to minimize the generation of mixed radioactive waste, this waste may be generated during dismantlement activities. Programs are in place to minimize the use of substances and practices that may generate mixed waste. If mixed wastes are generated, they will be managed according to EPA regulations, issued under Subtitle C of the Resource Conservation and Recovery Act (RCRA) and Michigan Department of Environmental Quality (MDEQ, Act 451) rules to the extent they are not inconsistent with NRC handling, storage and transportation requirements.

Mixed wastes from the Big Rock Point site are transported and shipped by authorized and licensed transporters to authorized and licensed facilities. If technology, resources, and approved processes are available, processes may be utilized to render the mixed waste nonhazardous.

Big Rock Point operates a RCRA/MDEQ, authorized hazardous waste storage facility for mixed waste generated during site operations. This storage facility can be also be utilized for temporary storage of mixed waste generated during decommissioning. The closure of the hazardous waste storage facility will be completed according to requirements and the timetable specified in an RCRA Closure Plan approved by the MDEQ prior to closure. Following Consumers Energy Company closure of this portion of the site, EPA/MDEQ staff may request a detailed site investigation to evaluate the potential that a release has occurred. If a release has occurred, corrective actions will be addressed.

4.3.6 Radioactive Waste Minimization

Big Rock Point has established site programs to minimize the generation of low level radioactive waste. These programs include plant procedures to ensure volume reduction is considered in projects, plant policies on control of tools to minimize the number of contaminated tools, and the use of offsite vendors for waste processing. All workers that frequent the radiologically controlled area of the plant receive Basic Radiation Worker Training. This training provides the purpose, effect and benefits from an effective volume reduction program.

Big Rock Point continues to utilize offsite vendors for radioactive waste processing. The vendor(s) selected utilize techniques that ensure that maximum efficiency for each package of radioactive waste is obtained. These techniques include incineration of dry active waste, super compaction, metal melting, and decontamination for free release.

4.4 NONRADIOLOGICAL EFFECTS

This section addresses the nonradiological factors which impact the environment including concerns for the industrial safety of workers, noise levels generated by dismantling activities, water utilization and the disposal of hazardous, nonhazardous and mixed waste products.

4.4.1 Industrial Safety

This section provides an overview of the Big Rock Point Decommissioning Industrial Safety Program.

4.4.1.1 Management Policy Statement

Consumers Energy Company is committed to the safe decommissioning of Big Rock Point. The primary objective of the Industrial Safety Program is to protect workers and visitors from industrial hazards that have the potential of developing during decommissioning activities and to achieve an injury and incident free workplace. Consumers Energy Company provides sufficient qualified staff, facilities, and equipment to perform decommissioning in a safe and effective manner. Consumers Energy Company is committed to compliance with all applicable federal (OSHA) and state (MIOSHA) regulations and to the guidance provided through industry standards and good work practices.

4.4.1.2 Industrial Safety Organization and Functions

The Industrial Safety Program provides the basis for controlling safety during decommissioning activities. The purpose of the safety organization is to ensure that the standards of safety are maintained through effective implementation of the Industrial Safety Program. The effective implementation of the Industrial Safety Program is the responsibility of all decommissioning personnel (these are functions, not always titles):

a. Site General Manager

The Site General Manager has the overall responsibility for safe operation of the plant and has control over those on-site resources necessary to meet this objective. Included in this is the responsibility for assuring effective implementation of the Industrial Safety Program and assuring that all organizations involved with decommissioning are coordinated to achieve the goals of providing a safe work place and the reduction of industrial hazards.

b. Employee Services Manager

The Employee Services Manager has responsibility for the implementation and maintenance of the Industrial Safety Program through site procedures and programs and supervises site safety professional(s).

c. Decommissioning Supervisors

All supervisory personnel are responsible for the supervision and direction of safety practices during decommissioning activities.

d. Decommissioning Workers

All plant and decommissioning workers are responsible for their own safe work practices as presented in site Accident Prevention Manual, procedures, policies, and applicable federal and state regulations.

4.4.1.3 Program Description

The Big Rock Point Industrial Safety Program establishes and maintains a safe work place for workers, contractors, and visitors. The program provides guidelines and procedures to be used to reduce industrial hazards and risks. The site Health and Safety Plan in conjunction with the Big Rock Point Accident Prevention Manual define specific programs and requirements to ensure worker protection.

4.4.2 Noise

Big Rock Point is located in an area that is surrounded on three sides by dense coniferous and deciduous forests. The nearest residence is approximately one mile from the property boundary and the nearest recreational area is adjacent to the property boundary (see Section 3.1). The city of Charlevoix is the nearest population center, located 3.5 miles from the site. Normal activities at the facility seldom produce noise levels that are perceptible at the property boundary.

Decommissioning activities will add minimally to ambient sound levels beyond the site boundary. Activities such as the operation of construction equipment may be audible along US Route 31 and over Lake Michigan. However, the operation of construction equipment will be intermittent and temporary, occurring primarily during the daylight hours. With the exception of the onsite evacuation alarms, it is anticipated that any noise beyond the site boundary will be well below 50 dBA, the level above which sound may initiate community complaints.

4.4.3 Fugitive Dust

The Big Rock Point site generally consists of stabilized soils with vegetative cover, beaches, or paved surfaces, as well as several buildings. During the various demolitions and dismantling operations, fugitive dust will be generated. Disturbances to the site may involve the controlled removal of buildings or structures, removal of piping and related components, and excavation to remove components such as underground utilities or potentially contaminated soils.

Reasonable control measures will be utilized to minimize the quantities of fugitive dust. The existing ventilation system, supplemented by localized HEPA filtration units, will monitor and filter particulate emissions from dismantling activities inside the containment and turbine buildings. Excavation of soils will include the use of wet suppression or chemical stabilization, as required, to minimize the generation of fugitive dust.

The controlled dismantlement and packaging of site components and structures will preclude fugitive dust from becoming an ambient air quality concern during the decommissioning process.

4.4.4 Water Utilization

This section describes environmental regulations governing water usage and discharge from Big Rock Point in addition to identifying plant-specific water sources and discharges.

4.4.4.1 Regulations

Water use and wastewater discharges at this facility are subject to both Federal and State environmental regulations and permitting.

a. Federal

The Federal Clean Water Act (as amended) mandates "restoration and maintenance of the chemical, physical, and biological integrity of the nation's waters." Section 402 of the Act established the National Pollutant Discharge Elimination System (NPDES) permitting program to regulate the discharge of water pollutants. The NPDES mandate under Section 402 of the Act was set into Federal regulations under 40CFR122, 123, 124 and 125. Since Big Rock Point Nuclear Plant is an electrical generating station that utilizes nuclear fuel in conjunction with steam as the thermodynamic medium, the plant operations are subject to Federal Effluent Guidelines and Standards for the Steam Electric Power Generating Point Source Category as set forth under 40CFR423.

This Federal regulatory framework governing the discharge of wastewater culminated in the issuance of NPDES Permit Number MI0001431 for Big Rock Point.

b. State

At the State level, wastewater discharges from Big Rock Point are addressed under provisions of Part 21, Wastewater Discharge Permits, and Part 4, Water Quality Standards, of the Michigan Water Resources Commission General Rules. This State regulatory framework governing the discharge of wastewater pollutants also culminated in the issuance of NPDES Permit Number MI0001431 for Big Rock Point.

c. <u>Big Rock Point NPDES Wastewater Discharge Permit</u>

The current plant NPDES permit was issued by the Michigan Water Resources Commission on August 23, 1990 and was subsequently amended on August 7, 1991 and again on February 23, 1993. The current permit expired by its terms on October 1994. However, in accordance with applicable Federal and State NPDES regulations, an application for NPDES permit renewal was submitted to the Michigan Department of Resources (MDEQ) on March 31, 1994 and April 1, 1999 [Reference 4.4-1]. The current permit remains in effect until such time as the renewal permit is issued. The site NPDES permit was renewed in May 2000 and expires in October 2004. A chronology of NPDES permitting at Big Rock Point is provided in Table 4.4-1. During the decommissioning, operation of certain plant systems will continue to require water use and discharge. All discharges will continue to be controlled under the NPDES permitting system.

4.4.4.2 Sources

Big Rock Point uses water directly from Lake Michigan as the source of water for the Service Water System (SWS) and Circulating Water System (CWS). Water is withdrawn from the lake via a 5-foot diameter intake pipe, located 1500 feet offshore at a depth of approximately 40 feet. The majority of the water is used for noncontact cooling and is discharged back to the lake.

The other source of water is groundwater from the site well water system. The principal use of groundwater is for the domestic water system. Section 3.1.3.2 provides a description of groundwater use for the plant domestic water system.

4.4.4.3 Discharges

The various plant outfalls and general water usage patterns are described below.

a. Outfall 001 - Combined Plant Discharge

Figure 4.4-1 diagrams the plant water utilization system and Figure 4.4-2 provides monitoring parameters for plant outfalls. During operating periods, the Big Rock Point plant was authorized under NPDES to discharge up to 75M gpd to Lake Michigan; however, the amount of discharge during decommissioning is significantly lower due to reduced use of the condenser circulating water system (CWS). One CWS pump is used to facilitate liquid radioactive batch releases.

The SWS provides cooling water to several systems and equipment including spent fuel pool cooling system and containment and turbine building air coolers. The SWS has a discharge limit of approximately 5M gpd. SWS discharge during decommissioning is not expected to approach authorized maximum levels.

Certain floor drains and yard drains also discharge through Outfall 001; these drains are clearly marked to prevent an inadvertant discharge to Lake Michigan. Additionally, the following internal outfalls flow into the combined plant discharge:

1. Water softener regenerate, carbon filter backwash, and reverse osmosis unit discharge (Outfall 00D);

2. Radwaste system wastewater (Outfall 00E);

3. Chemical waste tank wastewater (Outfall 00F);

4. Heating boiler blowdown and drainage (Outfall 00G); and

5. Stormwater runoff.

b. Outfall 00D - Water Treatment Discharge

This outfall is comprised of flows from water treatment system components including water softener regenerate, reverse osmosis unit, and carbon filter backwash discharge. Neither the discharge quantity nor flow rate is regulated for this outfall; however, typical discharge rates range from 6000 to 8000 gpd. It is anticipated that flows from this outfall will be under 8000 gpd during decommissioning.

c. Outfall 00E - Radwaste System

The maximum allowable flow through Outfall 00E is 5,500 gpd of radwaste system wastewater and includes post-treatment discharges from several radwaste tanks. The current radwaste system or a replacement thereto will be utilized during decommissioning and is not expected to exceed the authorized discharge flow rate.

d. Outfall 00F - Chemical Waste Tank

The chemical waste tank receives waste flows from miscellaneous lab and laundry activities. The maximum allowable chemical waste tank discharge is 5,500 gpd. This system will continue to operate during decommissioning and is not anticipated to exceed the authorized discharge limit.

e. Outfall 00G - Heating Boiler Blowdown and Drainage

Discharges resulting from heating boiler blowdown and drainage have a maximum flow of 2000 gpd. Heating boiler usage during decommissioning is expected to increase during the period fuel is stored in the fuel pool to compensate for the loss of reactor building heating previously met primarily by system heat losses during plant operation. Thus, flow through this outfall will remain relatively constant during this portion of decommissioning and within authorized discharge flow rates. During the safe storage interval, heating boiler use will be minimized, and the current heating system may be modified or replaced. Outfall during safe storage will not exceed authorized rates.

f. Outfall 002 Stormwater Runoff

An unspecified amount of stormwater runoff is discharged to Lake Michigan via Outfall 002. This outfall includes a network of storm drains connected to facility buildings and paved areas. Some plant floor drains are also connected to the storm water system; these drains are well-marked inside buildings to prevent inadvertent use. The site Storm Water Pollution Prevention Plan defines specific requirements for ensuring that no inappropriate discharges are made to the storm water system [Reference 4.4-2].

4.4.4.4 Effluent Limits and Effect

The Great Lakes, including Lake Michigan, are designated as "outstanding state resource waters" by the Michigan Water Quality Standards [Reference 4.4-3]. These water quality standards protect all Michigan surface waters for agricultural, industrial and public water supplies, aquatic life, wildlife, navigation and recreation. Lake Michigan is also designated as a coldwater lake which affords additional protection to support a year-round population of coldwater fish [Reference 4.4-4].

Anti-degradation requirements exist for Lake Michigan waters that have better water quality than the established water quality standards. These waters cannot be lowered in quality unless the Michigan Water Resources Commission determines that the degradation will not impair designated uses [Reference 4.4-3].

a. Discharges

The environmental effects of water discharges associated with plant operation since 1962 were minimal (refer to Section 3.2.1). The potential environmental effects associated with the decommissioning process will be even less because plant water usage is greatly reduced.

Figure 4.4-2 from the April 1, 1999 NPDES permit renewal application summarizes the NPDES required physical and chemical monitoring. Most internal outfalls are monitored for discharge flow rate and total suspended solids. The combined plant discharge to Lake Michigan is monitored for discharge flow rate, pH, discharge temperature, total residual oxidant (TRO), TRO discharge time, dehalogenation reagent use and outfall observation. Due to the high quality of the water discharged, these monitoring requirements are minimal when compared to monitoring requirements for other types of industrial water releases.

The basis for the issuance of the NPDES permit for Big Rock Point is expected to remain valid throughout decommissioning. Associated activities and discharges are less than during full plant operation. Therefore, it follows that the environmental effects of plant discharges will continue to be minimal or be reduced during the decommissioning period. Big Rock Point continues to monitor environmental parameters consistent with requirements of the NPDES permit. Additionally, MDEQ staff perform on-site annual NPDES Compliance Evaluation Inspections (CEIs).

b. Thermal Plume

The potential environmental effect of the plant's thermal plume in Lake Michigan was evaluated in 1975 under the initial NPDES permitting requirements. Thermal plume was defined as "that surface area of a lake warmed by a plant's thermal discharge to 3°F above ambient water temperature." The results of thermal plume measurements at Big Rock Point (and other Company generating facilities) were transmitted to the MDNR on November 12, 1976 in a report entitled Thermal Plume Monitoring Program [Reference 4.4-5].

Based on the results of the 1975 thermal plume study for Big Rock Point Nuclear Plant, it was determined that a Section 316(a) thermal plume analysis (Federal Water Pollution Control Act, 1972 Amendments) was not required for the plant. During the decommissioning process, there will be no discharge of condenser cooling water to Lake Michigan, resulting in essentially no measurable thermal plume.

c. Intake Study

Section 316(b) of the Federal Water Pollution Control Act Amendments of 1972 required that the location, design, construction and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impact. A "Section 316(b) Intake Study" for Big Rock Point Nuclear Plant was completed in 1975 [Reference 4.4-6]. Based upon the 316(b) intake study results, the MDNR determined in 1976 that Big Rock Point Nuclear Plant cooling water intake represented the best technology available to minimize adverse environmental impact. The intake status has remained as best technology available to present.

4.4.5 Impacts on Biological Resources

The following sections describe decommissioning impacts on adjacent waters and on terrestrial wildlife and vegetation.

4.4.5.1 Aquatic Resources

a. Surface Waters

No significant, long-term impacts on Lake Michigan are expected from decommissioning activities. The thermal plume created by discharge of condenser circulating water will be essentially eliminated when plant operation ceases. Short-term elevated turbidity levels may occur along the Lake Michigan shoreline near Big Rock Point Nuclear Plant should dismantling/removal of the Screenhouse and associated intake equipment occur. Briefly elevated turbidity levels are not anticipated to have any adverse impact on Lake Michigan waters near the plant.

b. Groundwater

No adverse impacts on groundwater are anticipated from decommissioning activities. In addition, the groundwater system under the plant area is effectively separated from any potential contact with local private wells. The down-gradient direction of groundwater flow is to the north toward Lake Michigan.

c. Flora

No current data are available on aquatic flora near the Big Rock Point site. NPDES limits will be maintained and water use reduced during decommissioning. Therefore, no adverse impacts to the aquatic flora are anticipated.

d. Fauna

No adverse impacts are anticipated from decommissioning activities. Impacts associated with full plant operation are minimal, and the potential impacts associated with the decommissioning process will be even less because plant water usage and discharge will be greatly reduced. Appropriate NPDES limits, as approved by the EPA/MDEQ, will be maintained during the decommissioning process.

4.4.5.2 Terrestrial Resources

a. Flora

The impact of decommissioning on flora is expected to be minimal. Impacts to floral resources outside the current plant industrial area are anticipated for the ISFSI and parking lot expansion.

b. Fauna

Because decommissioning activities will generally take place within the developed acreage on the plant property, impacts to fauna are anticipated only for the ISFSI and new parking areas.

4.4.6 Waste Management

Consumers Energy and Big Rock Point's waste management programs are applied to decommissioning wastes. This program continuously undergoes modification as required by Federal and State rules. The current program, as applicable to decommissioning wastes, is described as follows.

4.4.6.1 General

The requirements for the disposition of equipment and materials currently present at Big Rock Point depend on whether the material or equipment is categorized as a reusable product or as a waste. The categorization of product or waste is based on: (1) Federal Resource Conservation and Recovery Act (RCRA), (2) State of Michigan requirements (Act 451), and (3) the material's physical and chemical properties.

a. Materials which typically require classification as hazardous or nonhazardous waste, include the following:

1. Contents of separators (including sludge), sumps and other waste collection units;
2. Scrap metal;
3. Solvents (used and unused);
4. Mercury from various plant instruments;
5. Contents of storage tanks;
6. Chemicals in process equipment;
7. Chemicals in storage containers/drums;
8. Laboratory chemicals;
9. Boiler and equipment fuel;
10. Unused paint and paint thinners;
11. Unused janitor, maintenance and welding supplies;
12. Batteries;
13. Sludge in sewage lift station;
14. Insecticides, rodenticide, herbicides;
15. Demolition materials;

16. Substation equipment; and/or

17. Dried paint chips and scrapings.

b. All materials designated as waste are required to be evaluated to determine if the waste is hazardous according to RCRA and Michigan Act 451 criteria. The management requirements for handling these wastes depend on: (1) whether the waste is hazardous according to RCRA or Act 451 criteria, (2) the total quantity of all hazardous waste onsite, and (3) whether the waste is being disposed of or reclaimed.

c. Materials and equipment which can still be used without reclamation, are typically classified as products. Disposition of products are coordinated through the Consumers Energy Company's Investment Recovery Department.

d. During dismantlement waste handling staging area(s) may be used to facilitate the inventory, collection, categorization, and disposition of waste materials in containers. These areas provide adequate containment and segregation of potentially incompatible or reactive wastes and prohibit potential environmental release.

e. Chemicals used during decommissioning are evaluated for hazardous constituents or properties using RCRA/Act 451 criteria and the chemical's Material Safety Data Sheets (MSDS). Decontamination products wastes expected to be used during decommissioning include acids, caustics, detergents, and solvents. Detergents and water-based solvents are generally used for cleaning.

f. Sampling programs, such as paint composition and asbestos, are in place to identify the presence of potentially hazardous/regulated wastes during decommissioning work package planning.

Efforts are made during decommissioning work package development to minimize the production of wastes that are both radioactive *and* hazardous, i.e., mixed wastes. Generally acids and bases can be neutralized in a container and/or dispositioned offsite. All hazardous chemicals and materials used during decommissioning continue to be subject to a chemical control review to determine if a nonhazardous or a less toxic chemical can be substituted to prevent the generation of mixed wastes. In the event that hazardous chemicals or materials must be used, waste minimization techniques will be applied during usage. Steps will be taken to ensure that if a potentially hazardous material must be used, controls are in place to ensure these materials are not inadvertently contaminated with radioactivity. If any hazardous material does become radioactively contaminated, it will be considered as mixed waste, subject to applicable NRC, EPA and State regulations.

4.4.6.2 Nonradioactive Hazardous Waste

Based on waste stream inventory data, waste which has the potential to be hazardous is classified through MSDS information or analyses. A sampling, analysis and compositing method is utilized to properly classify and group similar wastes. Following classification, appropriate regulatory waste disposition options are evaluated and selected. Selection of disposition methods, in order of priority, will focus on: (1) reuse/recycle (onsite or offsite), (2) onsite elementary neutralization of acids or bases, and (3) offsite treatment.

All handling and dispositioning of hazardous wastes will be performed in accordance with Federal (RCRA) and State (Michigan Act 451) hazardous waste regulations and include the use of manifests.

a. Mercury

Mercury-containing instruments and switches will be consolidated and either drained or shipped offsite to a licensed mercury reclamation facility. Mercury drained from equipment will be reclaimed or processed by an authorized contractor.

b. Lead

1. Paints

Historically, lead-based paints have been used to coat steel components, concrete structures, and underground carbon steel piping. During the operating life of the plant, some lead-based paints may have been covered with several coats of other types of paint. In other cases, nonlead-based paint surfaces may have been coated or touched up with a lead-based paint. Lead-based paint identification and removal process controls have been implemented, in accordance with the Company's Lead Paint Removal Program and applicable OSHA/MIOSHA and EPA/MDEQ regulations to ensure proper handling of surfaces painted with lead-based materials and disposal of wastes.

2. Lead Shielding

Raw lead is used throughout the plant as shielding for radioactivity. Demolition of equipment/structures containing lead shielding may generate hazardous or mixed hazardous waste. Decommissioning work package planning incorporates efforts to minimize this waste. If a waste is determined to be hazardous for lead, it will be dispositioned in accordance with applicable OSHA/MIOSHA and EPA/MDEQ regulations. Raw lead may also be sent for reuse as shielding at other facilities.

4.4.6.3 Nonhazardous Solid Waste

Characterization surveys are performed in preparation for dismantlement of plant systems and/or structures. All waste materials are processed in accordance with the rules and regulations governing the disposition of nonradioactive, nonhazardous solid wastes. Materials are typically evaluated for the following as applicable:

a. Asbestos

The Environmental Protection Agency (EPA) and Occupational Safety & Health Administration (OSHA) have established regulations which apply to the demolition of any structure. Those structures that contain Regulated Asbestos Containing Material must conform to certain requirements for asbestos removal notification, recordkeeping, handling, and disposal. All activities involving asbestos are conducted in accordance with Federal and State regulations (OSHA 29CFR1910 and 1922, EPA 40CFR61, Subpart M), and also Consumers Energy Company requirements.

All asbestos removal work will be performed by a competent asbestos removal contractor using appropriately trained personnel. Asbestos will be packaged for shipment and disposed of at an authorized disposal site. Asbestos handling and disposal regulations outlined in the MDEQ's asbestos disposal policy and by the Michigan Department of Transportation (MDOT) are adhered to.

Generally, asbestos-containing materials should be handled to retard air emissions, collected in plastic bags, and labeled with "Asbestos Containing Waste." Asbestos shipments will be manifested. Disposal of asbestos will be prearranged at a licensed, Type II solid waste disposal landfill.

A significant quantity of the asbestos at Big Rock Point is radioactively contaminated. Radioactively contaminated asbestos is disposed of at a commercial radioactive waste disposal facility.

b. Polychlorinated Biphenyls

Big Rock Point has identified the presence of Polychlorinated Biphenyls (PCBs) above the EPA regulatory limit of 50 ppm (parts per million) in the dried paint of many plant components and structures. These components are regulated as PCB bulk product waste under 40CFR761. Big Rock Point will utilize waste processors licensed to store and dispose of PCB wastes in accordance with applicable federal regulations. All onsite storage of PCB bulk product waste is in accordance with EPA requirements.

c. Other Nonhazardous Solid Waste

Dismantlement requires the disposal of system and building wastes. These wastes will include materials that were never radiologically contaminated and those which otherwise meet the radiological release criteria, and are not classified as hazardous waste. Nonradioactive, nonhazardous wastes are expected to include:

1. System piping and components including pumps, valves, tanks, nonasbestos insulation, heat exchangers, and supports;

2. Duct work and associated equipment including ducts, fans, filters, and supports;

3. Electrical systems and equipment such as cables and trays, conduit, motor control centers, generators, motors, and panels; and/or

4. Buildings and structures including concrete, structural steel, roofing materials, siding, doors, and windows.

4.4.6.4 Nonhazardous Liquid Wastes

Following classification as a nonhazardous waste, liquids contained in drums, tanks, or sumps, are categorized to facilitate recycling, reuse, and/or disposal. Liquids transported offsite will be manifested and handled by approved disposal/recycling facilities.

4.4.6.5 Septic System Disposition

There are no legal requirements regarding abandonment of septic and tile field systems. Environmental health divisions of local county health departments have historically recommended that septic tanks be pumped out, tank tops caved in, and tanks back-filled with earth. Prior to abandonment of the septic system at the decommissioning dismantlement phase, a review with the Charlevoix County Health Department to determine the disposition of the plant septic system will be performed.

4.4.6.6 Underground Storage Tanks

There are three underground storage tanks still in use at Big Rock Point. One 10,000 gallon tank supplies fuel oil to the heating boiler, a 5,000 gallon tank contains diesel fuel for the main diesel generator and a 1,000 gallon tank provides fuel for the diesel fire pump. A fourth tank was abandoned in place and filled with sand. Under current Michigan regulations these tanks will require removal and closure.

4.4.6.7 Potential Environmental Response

The Michigan Environmental Response Act (MERA or Act 307) and Michigan Water Resource Commission (Act 245) require response actions to discovery of hazardous substance release to the environment. In the event that a hazardous substance release occurs or is discovered prior to or during decommissioning, arrangements will be made to continue or initiate remediation activities prior to site closure.

The Big Rock Point Spill Plan and associated attachments [Reference 4.4-7] remain in effect until such time as all of the materials in the plan, or additional polluting materials resulting from decommissioning/decontamination activities have been removed from site. If a spill to the environment occurs during the decommissioning process, it must be reported, evaluated, contained, cleaned up and removed.

4.5 REFERENCES

a. 4.1-1, M.J. Chang, "Replacement of Separator Shroud Bolts", contribution to BNL ALARA Notes (Number 9), Technical Report A-3259, February 1994

b. 4.1-2, R.A. English, "Source Term Components: Worker Dose Contributions at Big Rock Point", Consumers Power Company Internal Correspondence RAE 92-7, September 1992

c. 4.1-3, NUREG/CR-0672, Addendum 4, "Technology, Safety and Costs of Decommissioning a Reference Boiling Water Reactor Power Station: Comparison of Two Decommissioning Cost Estimates Developed for the Same Commercial Nuclear Reactor Power Station", December 1990

d. 4.1-4, Consumers Energy Company, "Big Rock Point Radiation Safety Plan"

e. 4.2-1, Consumers Energy Company, Big Rock Point Offsite Dose Calculation Manual, Section I, Revision 15

f. 4.3-1, NRC Bulletin 94-01, "Potential Fuel Pool Draindown Caused by Inadequate Maintenance at Dresden 1", Nuclear Regulatory Commission, April 14, 1994

g. 4.3-2, W.R. Pavlichko, "Fuel Pool Liner/Fuel Rack Corrosion Evaluation", December 1994

h. 4.3-3, T.R. Thiruvengadam, "Integrity of the Concrete Spent Fuel Pool for Long Term Storage of Spent Fuel during Safe Storage Period", December 1994

i. 4.4-1, NPDES Permit Renewal Application, April 1, 1999

j. 4.4-2, Consumers Energy Company, Big Rock Point Storm Water Pollution Prevention Plan, Volume 28, Section 2

k. 4.4-3, Michigan Water Quality Standards, Michigan Department of Natural Resources, Water Resources Commission General Rules, Part 4, 1986

l. 4.4-4, "Water Quality and Pollution Control in Michigan", Michigan Department of Natural Resources, June 1992

m. 4.4-5, Thermal Plume Monitoring Program, Consumers Power Company, September 1976

n. 4.4-6, Michigan Department of Natural Resources Intake Study, 1975

o. 4.4-7, Consumers Energy Company, Big Rock Point Spill Prevention Control and Countermeasure Pollution Incident and Prevention Plan, Volume 28, Section 1

Figure 4.4-1
<u>CONSUMERS ENERGY COMPANY BIG ROCK POINT PLANT</u>
<u>NPDES PERMIT MI0001431</u>

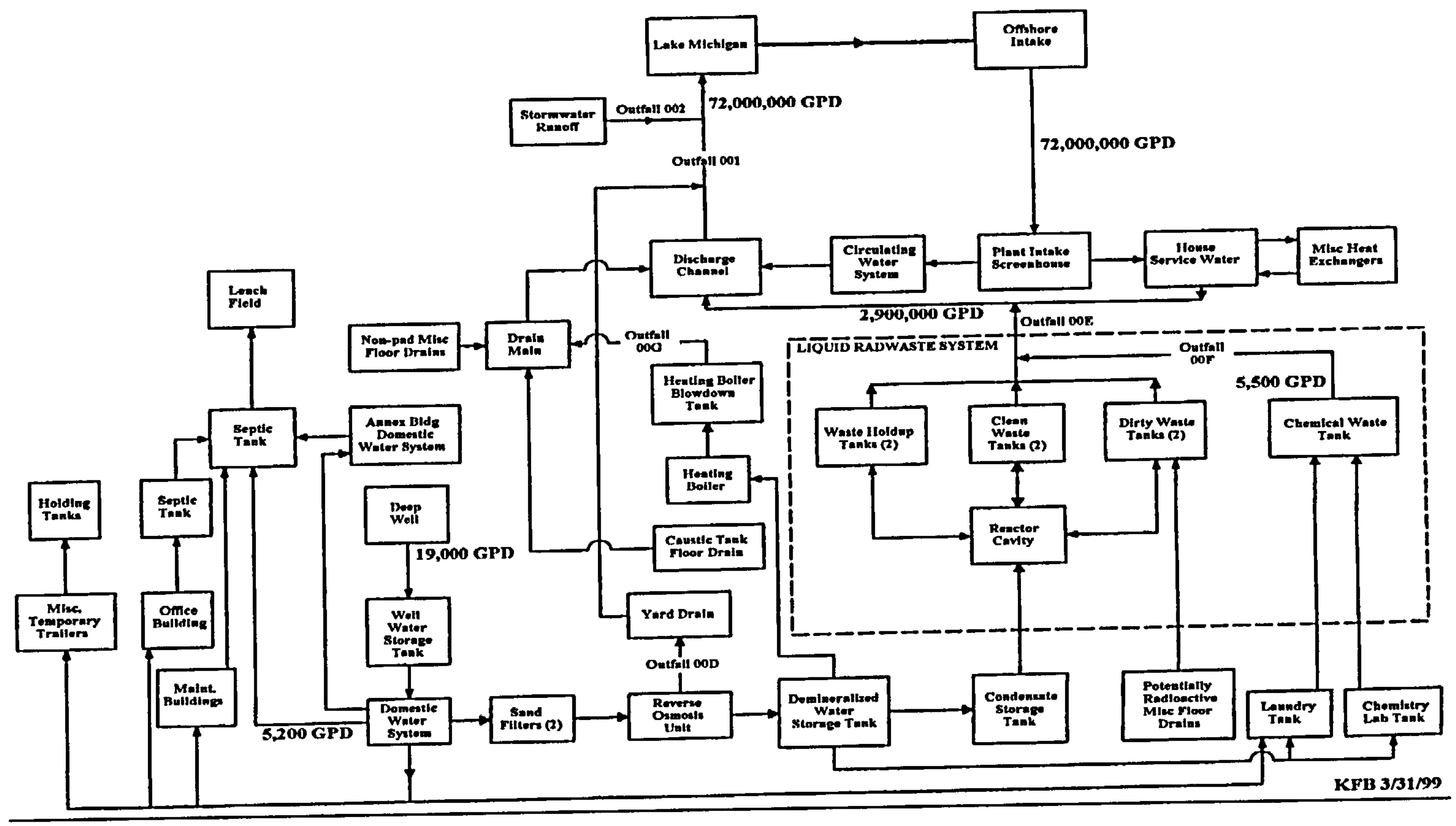
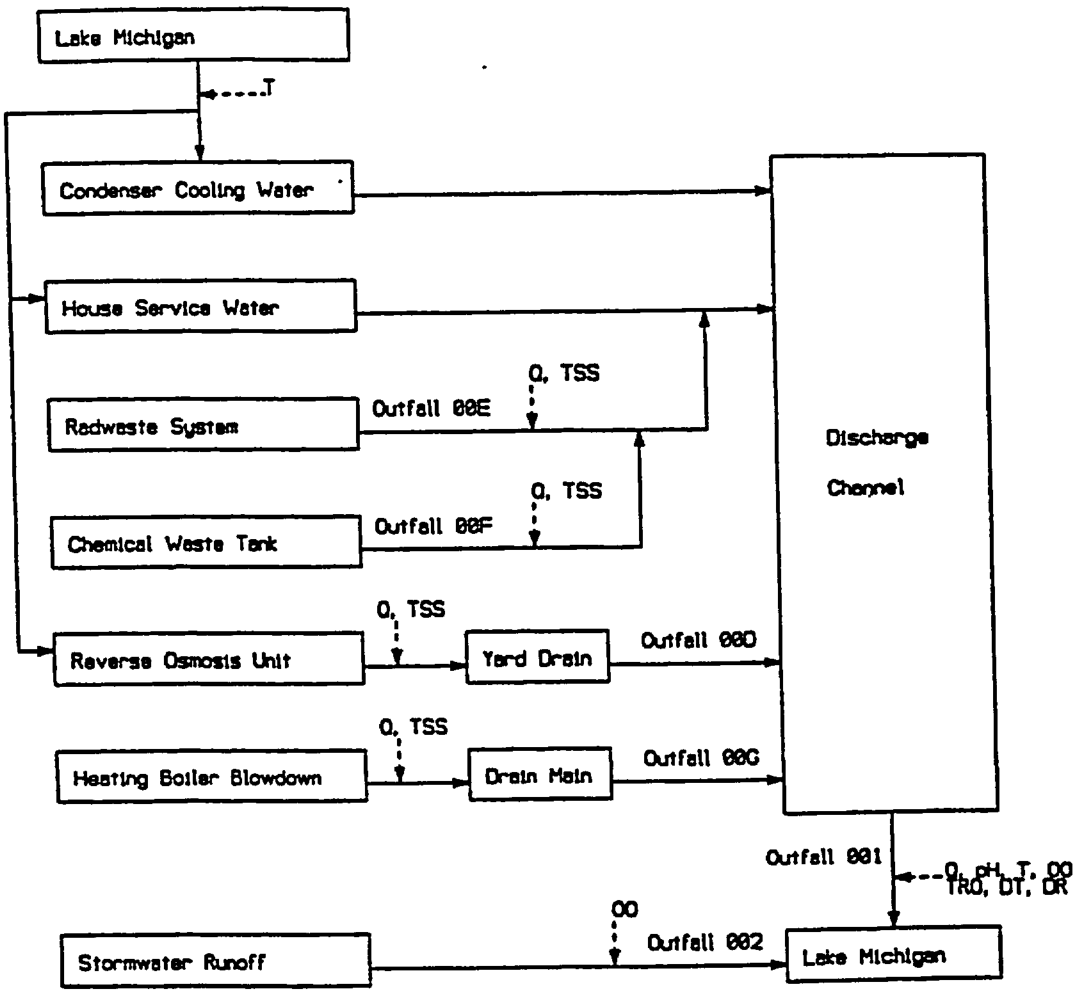


Figure 4.4-2
MONITORING PARAMETERS FOR BRP NPDES PERMIT



Parameters limited/monitored

T - Temperature	TRO - Total residual oxidant	TSS - Total suspended solids
Q - Flow	DT - Discharge time	O&G - Oil and Grease
pH - Hydrogen Ion	DR - Dehalogenation reagent	OO - Outfall Observation

TABLE 4.4-1

BIG ROCK POINT
CHRONOLOGY OF NPDES PERMITTING
NPDES PERMIT NUMBER MI0001431

APPLICATION DATE	ISSUANCE DATE	AMENDMENT DATE	EXPIRATION DATE
06/23/71 (Original) Amended 07/29/74	09/25/75	---	08/31/80
Amended 05/07/76	---	02/12/79	---
02/29/80 (Original for reissuance) Amended 10/18/84 Amended 05/31/85	08/22/85	09/17/87 05/03/89 (minor amendment)	07/31/90
02/02/90 (Original for reissuance)	08/23/90	08/07/91 02/23/93	10/01/94
03/31/94 (Original for reissuance)	Obsolete	---	---
04/01/99 (Original for reissuance)	05/01/00	---	10/01/04